electronicsForYou EXPRESS

APRIL 2023
VOL. 3 ISSUE NO. 6 • PAGES: 78

You Can BET YOUR FARM On IT

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V: 2 M/S
D: 15 M
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MUST READ

- A Three-Step Process To Predictable Sales
- Reference Designs Of Motor Drives For Different Applications
- The Mantras For High-Tech Startups' Success
- DIY: Your Own Supercomputer With Super Cool Tech

STARTUP #1

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Deciphering Brain With Semi-VR Cognitive Games

STARTUP #2

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thanks for asking.
electronics for you EXPRESS (aka EFY XP) is a sample of the flagship publication i.e. Electronics For You.

it's an e-zine. we don't print it.

we publish only select editorial from the main magazine in XP.

plus, we publish all the ads from the main magazine along with those booked for XP.

WHY?
it's a typical FREEMIUM offering where you get to read our content (some of it) for free, and if you like it and want all of it, you pay for the print or ezine edition of the main magazine.

we publish all ads of the magazine

DOES IT HELP?
oh yes!

we have seen subscriptions of the print and ezine editions go up month-over-month since the launch of XP in Oct 2020.

our overall readership of (selected) editorial and (all) advertisements has doubled.

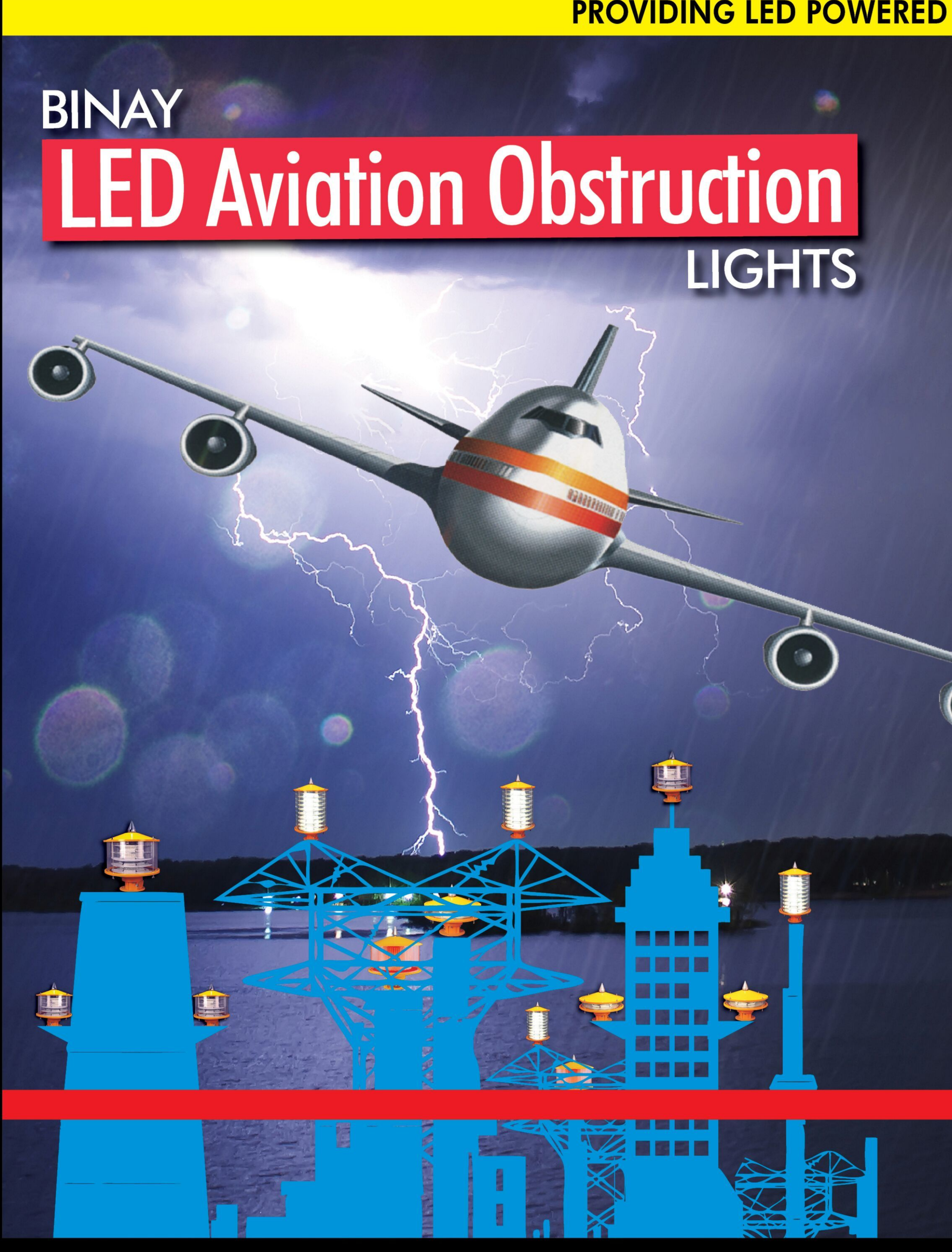
last 4 editions of XP witnessed average readership crossing 2-plus lakhs on our website alone!

XP also attracts readers through JioMags, Magzter, Facebook and LinkedIN on top of those who read it on our website.

NUTSHELL: Freemium is a great strategy to enable your targeted customers to try your product or service, and invest in it, if they find value.

PROVIDING LED POWERED

BINAY LED Aviation Obstruction LIGHTS



TECHNOLOGIES SINCE 1983

BINAY LED-based HIGH, MEDIUM and LOW Intensity Aviation Obstruction Light Beacons

As per International Civil Aviation Organisation (ICAO) requirements Available in Low Intensity, Medium Intensity and High Intensity versions (as per International Civil Aviation Organization guidelines), BINAY's patented LED Aviation Lights come with 5-year/3-year warranties

DESIGNED, DEVELOPED, AND MANUFACTURED IN INDIA

High Intensity
200,000 candela
(Flashing White LEDs)

Medium Intensity
20,000 candela
(Flashing White LEDs)

Medium Intensity
2,000 candela
(Flashing Red
OR Fixed Red LEDs)

All BINAY Aviation Lights are based on Non-switching passive type circuitry (NO SMPS)

The circuitry incorporated inside the LED Aviation Obstruction Lights is passive electronic (solid-state) in nature, and does not use internal SMPS driver switching units to control the light unit. Internal LED current control is by non-switching electronic means only. No electrolytic capacitors are used inside the Aviation Obstruction Light unit.

The above is necessary to ensure reliability of the LED Aviation Obstruction Light. This system design effectively eliminates any active components and circuits inside the aviation light itself, and enhances the solid-state passive reliability of the LEDs (mounted in relatively inaccessible locations at the height of tall structures). This drastically reduces the possibility of component failure - and hence possibility of any maintenance requirement – in the LED Aviation Obstruction Lights themselves (which are mounted at extreme heights in the system).

The BINAY LED Aviation Obstruction Light offers the following advantages:

- Fit-and-forget maintenance-free operation
- A long life of 100,000 hours (20 years at 12 hours daily burning)
- Pays for itself within a short period of operation in the form of reduced installation, maintenance and servicing costs
- Quick Installation; Reliable operation 365 days per year
- Shock-proof and vibration-resistant
- Over-Designed Intensity to allow for natural LED intensity degradation over its operating lifetime

LED Obstruction Lighting for:

- Industrial chimneys and smokestacks
- Transmission, microwave and cellular towers
- Radio, TV and similar structural towers
- High-rise buildings and structures
- Airports and airfields

THE BINAY LED OBSTRUCTION LIGHT IS UNDER ACCEPTED PATENT, AND AS SUCH IS A PROPRIETARY PRODUCT

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Email: info@binayLED.com
Website: www.binayled.com

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It all started with you.

To our associates, customers, partners, and suppliers–our mutual success over these fifty years has been driven by your passion, dedication, and loyalty. Together we've grown and excelled. And looking ahead, we know that an even brighter future awaits us all.

From us to you, we say thank you.

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from
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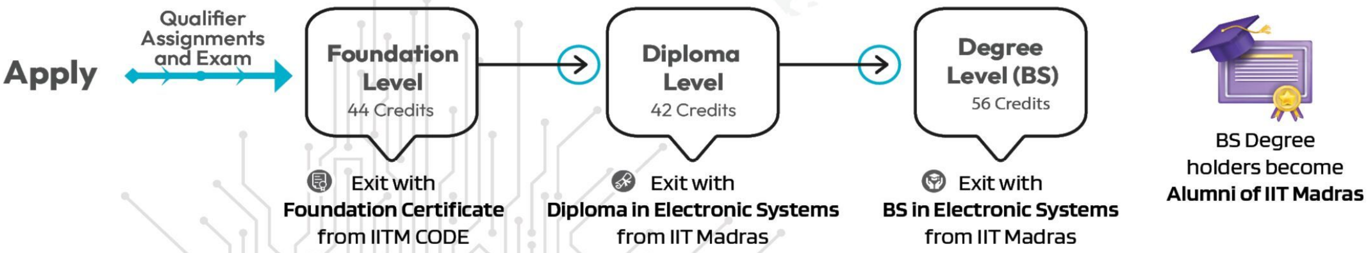

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Foundation Level: Exit with **Foundation Certificate** from IITM CODE

Diploma Level: Exit with **Diploma in Electronic Systems** from IIT Madras

Degree Level (BS): Exit with **BS in Electronic Systems** from IIT Madras

BS Degree holders become **Alumni of IIT Madras**

Admission Process

1. Login and Apply to the program
2. Study four weeks of Qualifier content
3. Pass the in-person Qualifier exam
4. Join the foundation level of the BS program

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- **No age limit to join**
- **Degree from IIT Madras**
- **Get employable skills**
- **Upskill/reskill as you work**
- **In-person Labs at IITM**
- **Multiple Exit options**
- **Placement assistance**

Career options

The major career options available to students taking this program include the following job positions in industries such as Automotive, Semiconductor and Defence:

- Electronic System Designer
- Embedded System Developer
- Electronic Hardware Specialist
- System Testing Engineer

The Graduates can also pursue higher studies in their area of interest.

Message from Director, IIT Madras

With the growing prominence of electronics in the current world scenario, education of electronics fundamentals at scale becomes crucial both for research & development and capacity building to meet the industry demand. Keeping this in mind, IIT Madras offers this BS course which we expect to help meet the need of our nation and aspirations of the student.

Prof. V Kamakoti
Director, IIT Madras

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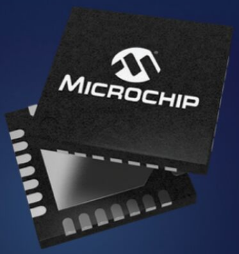

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FROM YOU

YOUR SUGGESTIONS AND THINGS YOU WANTED TO KNOW!

POWER SUPPLY FOR CLOCK

This is regarding the article on Power Supply for a Clock Using Supercapacitor and Small Solar Panels, which was published in February issue. Is this economical enough? A supercapacitor costs from ₹200 up to ₹7,500 and a solar panel costs from ₹100 up to ₹3,500. So, is this the right alternative for lithium-ion or alkaline batteries? Or, are there suitable means to increase their overall storage capacity so that they can replace the conventional primary or secondary batteries? Although a supercapacitor holds charge in the range of tens of Farads, their delivery of power over a long period is still below the actual field requirements.

Chithraa

EFY. *The author Dr Vijay Deshpande replies:*

"This is a good observation. The demand for energy storage devices is increasing exponentially. Following are broad guidelines through which we can try to meet the demand.

1. Explore all types of storage devices.

2. Try to take advantage of their unique features. For example, supercapacitors can be charged and discharged 100,000 times. So, they have three times more life than a lithium-ion battery—even after charging and discharging several times in a day. Also, supercapacitors are environment friendly.

3. The cost issue can be tackled by increasing demand and production. For that, we have to identify applications that are low lying fruits. This way, we can generate initial demand, which will result in reduced price. In turn, it will open up newer applications and improved capacitors.

The clock power supply circuit was designed with above points in mind. Even though it is a very small power application, it has the potential to eliminate tens of millions of AA and AAA batteries, thereby reducing their hazardous waste. Use of lithium-ion batteries for stationary applications is a waste of precious resource.

As far as solar panels are concerned, they have a long life of over 25 years. Problem is the initial cost. That is the reason the government is offering subsidies."

• • •

SMART WATCH

This is regarding the DIY article titled Wi-Fi Analysing Smart Watch published in March issue. How much current to ESP32 or ESP8266 GPIO pins can you provide? Can I directly connect the micro-sized vibration motor to the ESP8266?

Bidrohini

EFY. The maximum output current from one GPIO pin of ESP8266 is 12mA. In the case of ESP32, it is 40mA. Connecting a micro-sized motor directly to ESP8266 is a bad idea. Use a motor driver IC.

• • •

BATTERYLESS REMOTE PROJECT

What is the voltage range of LTC3588 and how much does the IC cost?

Gayathri

EFY. The piezoelectric energy harvester module LTC3588 can harvest energy from a selectable range of 1 to 3.3V. Its cost is around one thousand Indian rupees.

• • •

OLED USE WITH ARDUINO

Which Arduino is used for making the smart glasses using an OLED display?

Noxious

EFY. You can use any version of Arduino. The author used Arduino nano because of its small size in the project published in November issue.

• • •

HELP FOR ELECTRONIC PROJECT

How can we contact the authors for some help regarding their articles or projects published in Electronics For You as well as electronicsforu.com?

Aryan Surve

EFY. You can email your query to *onedit@efy.in* or discuss with experts using the EFY forum *https://www.electronicsforu.com/forums*

• • •

SUBMISSION OF PROJECT

What are the rules for submitting complete DIY project details for publication in Electronics For You?

Chithraa

EFY. Email your project details to *onedit@efy.in* or directly submit on *https://www.electronicsforu.com/submit-your-project*. The project will be published after review by EFY's editorial team and their approval.

• • •

ERRATA

On page No. 91 in EFY January issue under the heading Circuit and Working in DIY article Temperature Controlled Switch, the op-amp is mentioned as LM35 (IC3), while in Fig. 2 on the same page the op-amp IC is mentioned as LM358 (IC3A).

Sachin Goel

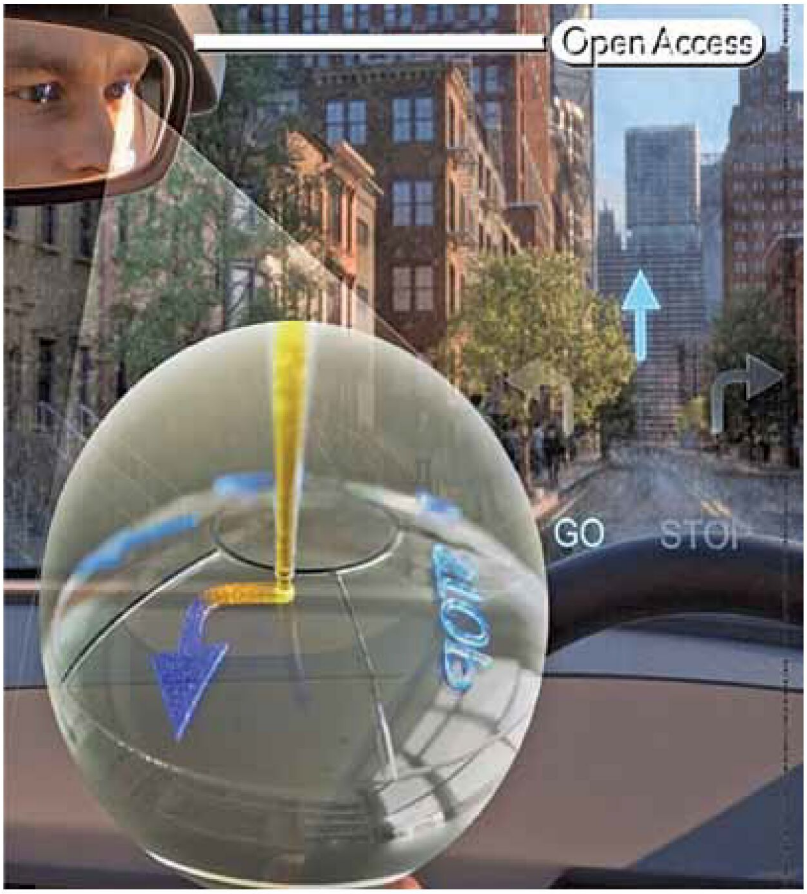
EFY. We thank Sachin for detecting this error and sharing with everyone! Please refer the circuit diagram for the correct nomenclature.

Letters and questions for publication may be addressed to Editor, Electronics For You, D-87/1, Okhla Industrial Area, Phase 1, New Delhi 110020 (e-mail: **onedit@efy.in**)

RESEARCH
& INNOVATION UPDATES

Smart contact lenses enable AR based navigation

A team of researchers from Ulsan National Institute of Science and Technology (UNIST) and KERI have developed core technology for smart contact lenses that can implement augmented reality (AR) based navigation with a 3D printing process. The key is the meniscus of used ink. The meniscus of the acidic-ferric-ferricyanide ink is formed on the substrate when the ink-filled micronozzle and substrate come in contact. Through the precise movement of the nozzle, the crystallisation of Prussian Blue is continuously performed, thereby forming micro-patterns. Simply by wearing a lens, navigation unfolds in front of a person's eyes through AR. Games such as the popular 'Pokemon Go' can also be enjoyed with the smart contact lenses. This technology is expected to be used mainly for navigation but can also be adapted for several other applications.



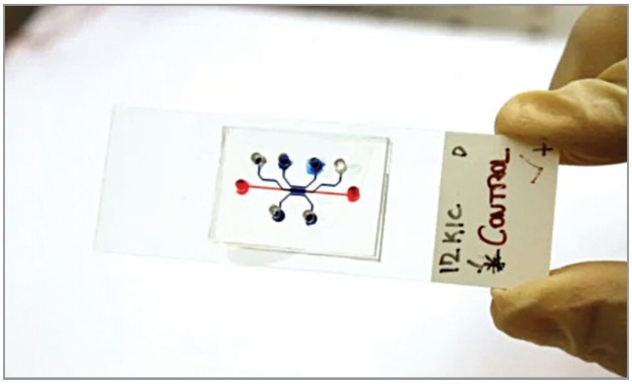
Meniscus-guided micro-printing of Prussian Blue is realised by the localised crystallisation of FeFe(CN)6 on the substrate confined by the ink meniscus and thermal reduction of the crystallised FeFe(CN)6. This strategy is capable of being used as an electrochromic display to give real-time directions on an augmented reality (AR) smart contact lens device (Credit: Advanced Science and Korea Electrotechnology Research Institute)

A new way to govern ethical use of AI

Researchers from Texas A&M University School of Public Health have developed a new governance model for ethical guidance and enforcement in the rapidly advancing field of artificial intelligence (AI) known as Copyleft AI with Trusted Enforcement, or CAITE. This model combines aspects of copyleft licensing and the patent-troll model—the two methods of managing intellectual property rights that can be considered at odds with one another. It uses a copyleft approach to ensure that developers who create derivative models and data must also use the same license terms as the parent works. The license would assign the enforcement rights of the license to a designated third-party known as a CAITE host. Hosts can set consequences for unethical actions, such as financial penalties or reporting instances of consumer protection law violations. The CAITE approach allows for leniency policies that can promote self-reporting and gives flexibility that typical government enforcement schemes often lack.

Cellular signal processing used to study cancer cells

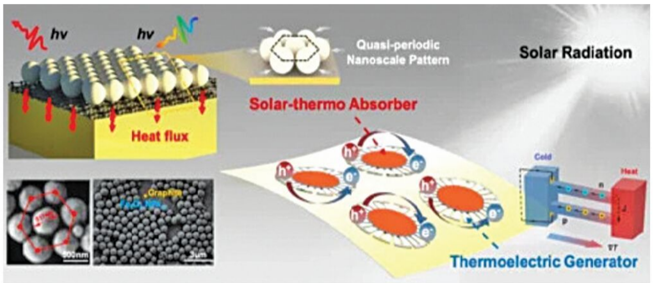
Purdue University researchers have reverse-engineered a cellular signal processing system and used it like a logic gate—a simple computer—to better understand what causes specific cells to migrate. Cancer cells are exposed to multiple cues that cause them to move. The team adopted a ternary logic gate model to analyse these cues and predict how cells would move under different environments. Their experiments took place in a microfluidic platform with a centre chamber for the cells and two side platforms. Using this device, they could replicate fluidic flows in one direction, in the opposite direction, or no flow at all. They assigned values to which direction the cells moved under the two different stimuli. Based on observations, the cues of these cancer cells could now be diagrammed much like an electrical engineer would diagram a circuit.



In microfluidic devices like this, Bumsoo Han's team observes how cancer cells behave in a simulated biological environment (Credit: Purdue University photo/Jared Pike)

A new solar harvester with enhanced energy conversion

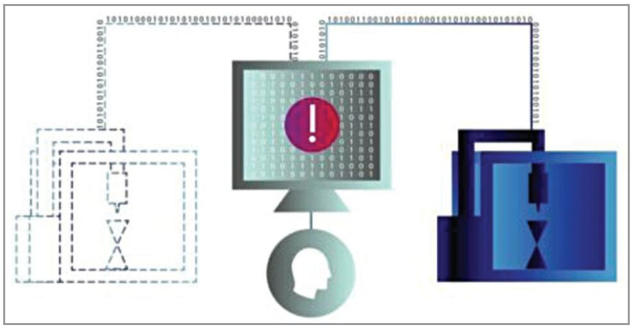
Researchers from Harbin University, Zhejiang University, Changchun Institute of Optics, and the National University of Singapore have designed a new solar harvester with enhanced energy conversion capabilities. The new design aims to simplify fabrication and reduce costs while improving performance. It uses a quasiperiodic nanoscale pattern—meaning most of it is an alternating and consistent pattern, while the remaining portion contains random defects (unlike a nanofabricated structure) that do not affect its performance. Scientists built a flexible planar solar thermoelectric harvester, which reached a significant sustaining voltage of over 20 millivolts per square centimetre. They expect it to power 20 light-emitting diodes per square metre of solar irradiation. Researchers believe this strategy can serve low-power-density applications for more flexible and scalable engineering of solar energy harvesting.



These images show the device's solar-thermal conversion (left) and solar thermoelectric harvesting (right) (Credit: Zifu Xu)

Digital twin together with ML can now flag cyberattack indicators

A team of researchers at the National Institute of Standards and Technology (NIST) and the University of Michigan has devised a cybersecurity framework that brings digital twin technology together with machine learning and human expertise to flag indicators of cyberattacks. The team built a digital twin to emulate the 3D printing process and provided it with information from the real printer. As the printer built a part, computer programs monitored and analysed continuous data streams, including both measured temperatures from the physical printing head and the simulated temperatures being computed in real time by the digital twin. In other words, the models were adept at recognising what the printer looked like under normal conditions, also meaning they could tell when things were out of the ordinary.



A new and improved strategy for detecting cyberattacks on manufacturing systems, such as 3D printers, involves using AI to monitor a digital twin that mimics and is fed real-time data from the physical system (Credit: N. Hanacek/NIST)

Believable tactile experience in VR made possible

Researchers from Rice University, Baylor College of Medicine, and Meta Reality Labs have found a hands-free way to deliver believable tactile experiences in virtual environments. This new multisensory pseudo-haptic technology uses a combination of visual feedback from a VR headset and tactile sensations from a mechanical bracelet that squeezes and vibrates the wrist. It includes both tactile sensations conveyed through skin and kinesthetic sensations from muscles and tendons. The device, named Tasbi, has a motorised cord that can tighten and squeeze the wrist, as well as a half-dozen small vibrating motors—the same components that deliver silent alerts on mobile phones—which are arrayed around the top, bottom, and sides of the wrist. When and how much these vibrate and when and how tightly the bracelet squeezes can be coordinated, both with one another and with a user's movements in virtual reality.

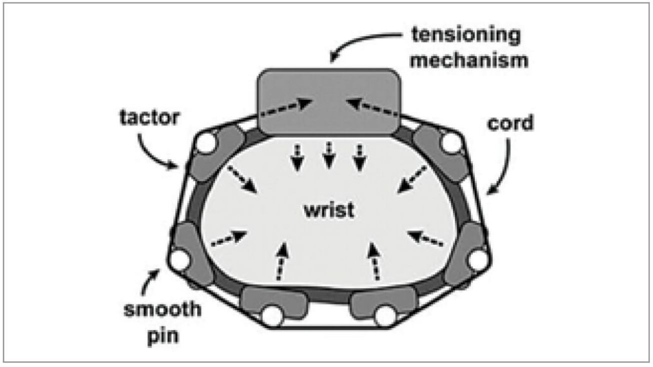


Illustration of the components in the Tabsi tactile bracelet (Credit: MAHI Lab/Rice University)

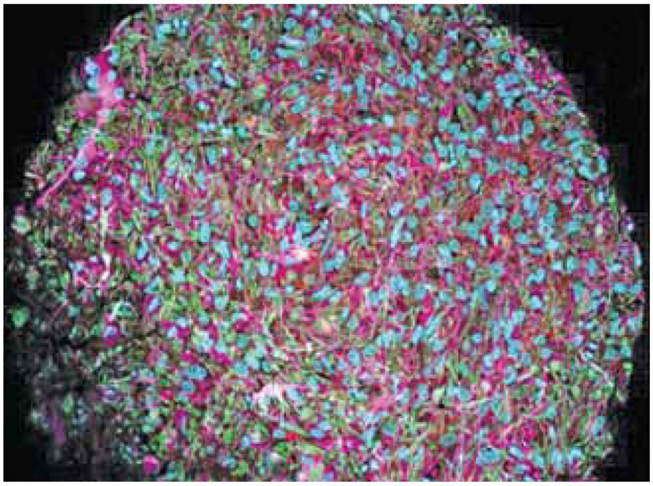
Issues being addressed to make solid-state batteries competitive

Researchers from Justus Liebig University Giessen, University of Münster, and Helmholtz Institute Münster of Forschungszentrum Jülich (Germany) analysed the current state of the technology, critically considering the challenges and the unresolved issues which must be addressed to make solid-state batteries competitive. The aim is to use a solid electrolyte in solid-state batteries, promising better storage properties, longer lifetimes, and increased safety. A key point for the development of solid electrolytes, which can ensure higher battery performance and safety at the same time, is having as low concentration of lithium as possible. Moreover, a maximum-capacity anode material is required, which enables the battery to have less volume and weight.

Doctoral student Laura Goodwin from Justus Liebig University Giessen with a solid-state cell on a laboratory scale (Credit: JLU/Rolf K. Wegst)

Brain-cells powered biocomputer could help modern computing

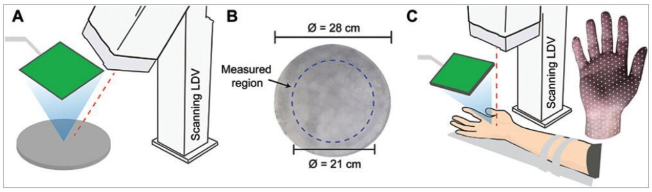
Researchers at Johns Hopkins University believe a biocomputer powered by human brain cells could be developed within our lifetime to exponentially expand the capabilities of modern computing and create novel fields of study. Thomas Hartung, a professor of environmental health sciences at Johns Hopkins, began to grow and assemble brain cells into functional organoids in 2012 using cells from human skin samples reprogrammed into an embryonic stem cell-like state. Each organoid contains about 50,000 cells, about the size of a fruit fly's nervous system. He now envisions building a futuristic computer with such brain organoids. But at current pace it would take decades before organoid intelligence can power a system as smart as a mouse. This problem can be tackled by scaling up production of brain organoids and training them with artificial intelligence.



Magnified image of a brain organoid produced in Thomas Hartung's lab, dyed to show neurons in magenta, cell nuclei in blue, and other supporting cells in red and green (Credit: Jesse Plotkin/Johns Hopkins University)

New holographic haptic displays can create better VR experiences

A team of researchers from UC Santa Barbara has discovered a new phenomenon that underlies emerging holographic haptic displays, which could lead to the creation of more compelling virtual reality experiences. Researchers used high-resolution optical imaging, simulations, and perception experiments to study ultrasound-excited waves that are excited in the skin during haptic holography. They discovered that holographic displays excite widespread vibration patterns—shear shock waves—in the skin. Shock waves create a trailing wake pattern that extends beyond the intended focal point, reducing the spatial precision and clarity of the tactile sensations. If the focused sound beam is a fast-moving boat on the water, the shock wave pattern is a wake trailing the boat. Current holographic haptic displays excite shock wave patterns that are so spread out in the skin that the sensations feel very diffuse.



Time-resolved optical vibrometry characterisations were obtained during focused ultrasound stimulation of a tissue phantom and human hands (Credit: Science Advances, 2023)

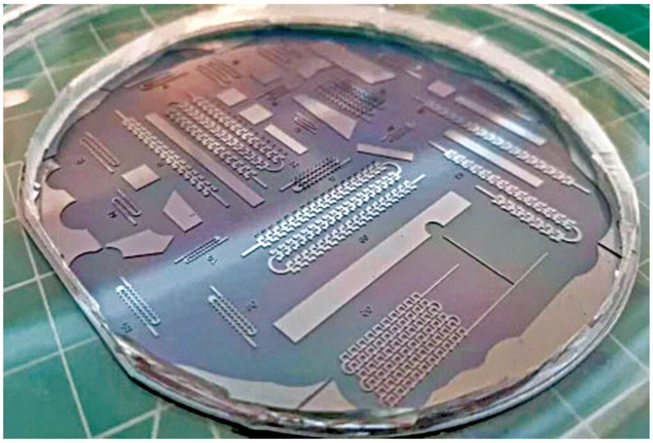
A soft and flexible replica of a heart can now be 3D printed

Massachusetts Institute of Technology (MIT) engineers have developed a procedure to 3D print a soft and flexible replica of a patient's heart. They can then control the replica's action to mimic that patient's blood-pumping ability. Researchers took advantage of 3D printing to produce custom replicas of actual patients' hearts. They used a polymer based ink that, once printed and cured, can squeeze and stretch, similarly to a real beating heart. They used medical scans of 15 patients diagnosed with aortic stenosis. The team converted each patient's images into a three-dimensional computer model of the patient's left ventricle and aorta. They fed this model into a 3D printer to generate a soft, anatomically accurate shell of both the ventricle and vessel. The team used an actuated printed heart to compare implants of different sizes, to see which would result in the best fit and flow—something they envision clinicians could potentially do for their patients in the future.

MIT engineers are hoping to help doctors tailor treatments to patients' specific heart form and function, with a custom robotic heart. The team has developed a procedure to 3D print a soft and flexible replica of a patient's heart (Credit: Melanie Gonick, MIT)

New device can detect and analyse cancer cells from blood samples

Researchers from the University of Technology Sydney (UTS) have developed a new device that can detect and analyze cancer cells from blood samples, enabling doctors to avoid invasive biopsy surgeries and monitor treatment progress. The new detection technology has 38,400 chambers capable of isolating and classifying the number of metabolically active tumor cells. Once the tumor cells are identified with the device, they can undergo genetic and molecular analysis, which can aid in the diagnosis and classification of the cancer and inform personalised treatment plans. This new technology is designed for integration into research and clinical labs without relying on high-end equipment and trained operators. This will enable doctors to diagnose and monitor cancer patients in a practical and cost-effective manner.



The Static Droplet Microfluidic device is able to rapidly detect circulating tumor cells that have broken away from a primary tumor and entered the bloodstream (Credit: Dr Majid Warkiani)

A novel supercapacitor design that offers multiple advantages

Researchers from Chung-Ang University have fabricated a structure comprising multilayer electrodes vertically integrated within a single sheet of paper. The novel design overcomes the problems associated with stacked sheets while retaining the inherent advantages of a paper based substrate. The supercapacitor design showed a low electrical resistance, high foldability, and good mechanical strength. Manganese dioxide enhanced its active surface area, which further boosted the electrochemical performance. Additionally, the supercapacitor demonstrated high energy storage with maximum areal energy and power densities of 13.73μW-hr-cm^{2} and 1.6mW-cm^{2}, respectively. Moreover, it retained its storage capacity even after undergoing 6,000 charge-discharge cycles. Researchers say that their method of fabrication circumvents most fabrication challenges related to two-dimensional energy storage sheets.

Now an artificial throat with 99% speech accuracy developed

Researchers at Beijing's Tsinghua University have developed an artificial throat capable of recognising speech elements and generate speech at an accuracy rate of 99%. They designed a wafer-like tool one centimetre square that can easily be affixed to the throat and allow barely audible sounds, or even whispers, to be converted into speech at normal volume. Researchers refer to this device as a "graphene-based intelligent, wearable artificial throat." The 25-micrometre deep device may be applied to one's throat with a simple adhesive. Tiny wires connect to a microcontroller powered by a coin-sized battery. This artificial throat is capable of recognising speech elements such as phonemes, tones, and words at an accuracy rate of 99%. It relies on an artificial intelligence model to interpret captured sounds and bodily vibrations to generate vocalisations.

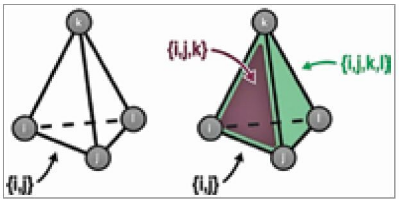
Algos for robots to adapt to the surroundings and learn being created

Columbia Engineering and Toyota Research Institute computer scientists are looking into psychology, physics, and geometry to create algorithms so that robots can adapt to their surroundings and learn how to do things independently. Researchers taught neural networks the basic physical concepts that come naturally to adults and children. The key idea is to train the computer to anticipate what the scene would look like in the future. Researchers modified the Iterative Residual Policy (IRP) algorithm, which showed sub-inch accuracy by demonstrating its strong generalising capabilities. They developed a new approach to manipulating them by using actively blown air. The self-supervised learning framework they call DextAIRity learns to effectively perform a target task through a sequence of grasping or air based blowing actions. Using visual feedback, the system uses a closed-loop formulation that continuously adjusts its blowing direction.

The self-supervised learning framework Columbia Engineers call DextAIRity learns to effectively perform a target task through a sequence of grasping or air based blowing actions. Using visual feedback, the system uses a closed-loop formulation that continuously adjusts its blowing direction (Credit: Zhenjia Xu/Columbia Engineering)

Insights from biology help improve computer model of memory

Researchers at the Okinawa Institute of Science and Technology (OIST) have made improvements to a widely utilised computer model of memory, known as a Hopfield network, by incorporating insights from biology. The network is 'trained' to encode these patterns, then researchers test its memory by presenting a series of the blurry or incomplete patterns and seeing if the network can recognise them as one it already knows. Researchers created a modified Hopfield network in which not just pairs of neurons but sets of three, four, or more neurons could link up too, such as might occur in the brain through astrocytes and dendritic trees. The new network allowed these so-called 'set-wise' connections; overall it contained the same total number of connections as before. Researchers found that a network containing a mix of both pairwise and setwise connections performed best and retained the highest number of memories.



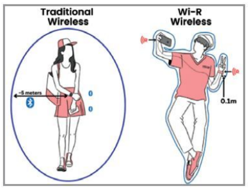
In the classical Hopfield network (left), each neuron (I, j, k, l) is connected to the others in a pairwise manner. In the modified network made by Burns and Professor Fukai, sets of three or more neurons can connect simultaneously (Credit: Thomas Burns, OIST)

TRULY INNOVATIVE ELECTRONICS

INNOVATION UPDATES

Amongst numerous press releases of new products received by us, these are the ones we found worthy of the title *Truly Innovative Electronics*

Non-radiative wireless solution



Ixana's Wi-R solution utilise non-radiative wireless signal to transfer data. It consumes up to 100 times lower energy compared to the existing Bluetooth and Wi-Fi protocols. Ixana offers Wi-R solution through YR11, YR22, and YR33 chips that offer a speed of up to 1Mbit/s, 4Mbit/s, and 20Mbit/s, respectively. The high-speed, low-powered solution enables distributed AI with a wireless hub. This technology utilises a human body as a conductor and confines the signal around the user's body. It can allow engineers to design devices that provide robustness, efficiency, and touch selectivity of the signal. It also enhances safety of the system by having a short transmission range from the body and featuring mathematical security that comes from encryption. The Wi-R solution is suitable for use in wearables and audio devices like wireless headphones and smart watches.

Ixana.ai
https://ixana.ai

AC direct DC power IC

Amber Semiconductor's AC direct DC power delivery IC is capable of extracting DC directly from AC mains without the use of transformers, rectifier bridges, or filtering. The AC direct DC enabler silicon chip enables dynamic delivery of DC power on demand. It requires lesser components for achieving power conversion, thus reducing the size, cost, and complexity for designing a power converter. It can take a wide range of input from 25 to 277V AC to provide a DC output of 1.8V to 24V. AC direct DC power delivery will enable engineers to develop low-cost, compact power supplies or products running on low-voltage DC. It is suited for a broad range of electrical products, such as smoke detectors, doorbell cameras, thermostats, smart products, appliances, and intelligent HVACR.

Amber Semi
https://ambersi.com

High-efficiency application processor

R2 FastLane Core Power is an application processor by R2 Semiconductors that can improve overall system performance. The application processor offers higher efficiency by reducing heat generation and supports both fast changing load voltages and currents. It is based on a high switching frequency, high bandwidth technology, which enables dynamic voltage and frequency scaling to adjust power supply voltage, match load conditions, reduce wasted power consumption and heat. R2 will enable system on chip developers to integrate efficient power management, thereby reducing form factor and noise interference. It will help design devices with improved system performance, smaller footprint, better thermal management, and reduced power consumption, thus, reducing the size and cost of the product.

R2 Semiconductors
https://r2semi.com

Moisture and temperature sensor

AXZON AZN3100-AFR
Moisture and Temperature
Powered by Magnus

The AZN3100 from Axzon is a flexible, wireless, battery-free moisture and temperature sensor. It is designed to monitor environmental and material moisture and temperature content over a wide range of settings. The sensor has a read range of up to 8 metres and is optimised for direct contact with moisture or water droplets. The AZN3100 incorporates an integrated RF antenna to harvest energy for the moisture sensing function, as well as to communicate with a RAIN/UHF compliant reader. The integrated antenna, configured to be sensitive to moisture and rain, is built using flexible materials with a built-in adhesive strip. The sensor can be used to detect moisture and temperature in applications that include bulk material like grain, food products, as well as building and roofing materials.

Axzon
https://www.axzon.com

Photoelectric sensor front-end

TRIAD semiconductor
TS8003

Triad Semiconductor's TS8003 is a highly integrated photoelectric sensor analogue front-end IC. It combines an optical source modulated transmit driver, dual high-performance photodiode receive channels, high input voltage DC-DC converter/linear regulators, and user configurable high-voltage IO-Link/binary output stages in a single chip. The TS8003 comes in a compact 30-bump wafer level chip scale package (WLCSP, 2.6mm × 3mm, 0.5mm pitch). It can operate over 9 to 36V nominal supply input and over -25 to +85°C operating temperature range. The TS8003 provides a complete mixed-signal interface solution for multiple application modes and the next generation of small sensor form factors. It is highly configurable and suitable for through-beam retro-reflective and diffuse (proximity sensing) photoelectric sensor applications.

Triad Semiconductor
https://triadsemi.com

SoC for IoT devices

Silicon Labs BG27 is a new addition to company's xG27 system on chip (SoC), which enables secure, energy-friendly multiprotocol wireless networking for IoT devices. The BG27 comes in a compact packaging measuring just 2.6mm × 2.3mm. It can enable medical device makers to integrate Bluetooth LE connectivity on devices with small form factor, such as the smart tooth implant. The BG27 enables device makers to add high performance and secure low-power Bluetooth LE on tiny form factor devices, expanding the possibilities of smart connected medical devices and wearables. The SoC features an integrated DC-DC boost that allows operation down to 0.8 volts, thus enabling the use of single-cell alkaline, silver oxide, and 1.55V button cell batteries typically used in medical applications such as battery-operated patches, wearable electrocardiograms, and continuous glucose monitors.

Silicon Labs
https://www.silabs.com

Tiny ultra-fast servo drives

Celera Motion's Denali series is a line of ultra-fast, compact servo drives suitable for extremely sensitive medical and industrial applications. The servo drives can work in the 250W power range and are designed for surgical robotics, end-effectors, haptic devices, small joints, and other compact robotics applications. The drives are the world's smallest, weighing just 8 grams. The Denali series features EtherCAT and CANopen communication protocols, optimised for demanding multi-axis applications. It supports EtherCAT with a bus latency down to 1 cycle, which improves the cost-efficiency of embedding multiple axes into a single PCB. The servo drive will reduce the cost, size, and time of manufacturing. The high efficiency and low standby power consumption of device make it suitable for use in service robots, surgical robots, industrial grippers, and lab automation applications.

Celera Motion
https://www.celeramotion.com

Single-chip BMS controllers

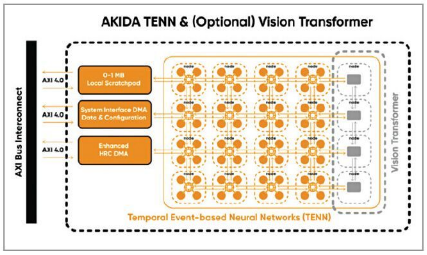
Qorvo PAC22140 and PAC25140 are the industry's first single-chip power application controllers to offer support for battery packs with up to 20 cells in series. The highly integrated controllers save designers more than 50% of PCB space and lower the material cost by 30%, while reducing time to market, leveraging Qorvo's hardware and firmware ecosystem. The devices integrate all essential analogue and power management peripherals with a 32-bit Arm Cortex M0 or M4F microcontroller and include cell balancing, monitoring, and protection for 10- to 20-cell battery packs. They leverage an intelligent motor control foundation to enable intelligent battery management solutions (BMS) for a wide range of industrial, e-mobility, and battery backup applications.

qorvo
PAC22140

Qorvo
https://www.qorvo.com

Powerful neural processing system

BrainChip's second-generation Akida platform is a powerful neural processing system, architected for embedded edge AI applications. The 2nd Gen Akida platform offers efficient 8-bit processing suitable for time domain convolutions and vision transformer acceleration, for high level of performance in sub-watt devices. It includes temporal event based neural nets spatial-temporal convolutions that supercharge the processing of raw time-continuous streaming data, such as video analytics, target tracking, audio classification, analysis of MRI and CT scans for vital signs prediction, and time series analytics used in forecasting and predictive maintenance. The Akida platform offers simpler implementations by consuming raw data directly from sensors, which drastically reduces model size and operations performed, while maintaining very high accuracy. This can enable design engineers to shrink design cycles and lower the cost of development.


AKIDA TENN & (Optional) Vision Transformer
AXI Bus Interconnect
AXI 4.0
AXI 4.0
AXI 4.0
0-1 MB Local Scratchpad
System Interface DMA Data & Configuration
Enhanced HRC DMA
node
Vision Transformer
Temporal Event-based Neural Networks (TENN)

BrainChip
https://brainchip.com

VPUs for intelligent cameras

The Hailo 15 family of vision processors (VPUs) will introduce the AI capabilities to cameras used in a wide range of applications for different industries. It is designed for integration directly into intelligent cameras to deliver video processing and analytics. The Hailo 15 series offers processing power up to 20 tera operations per second, thus delivering over 5x higher performance than currently available solutions in the market, at a comparable price point. All Hailo 15 VPUs support multiple input streams at 4K resolution and combine a powerful CPU and DSP subsystems with Hailo's AI core. The Hailo 15 VPU will enable identification of smaller and more distant objects with higher accuracy and less false alarms.

HAILO
Hailo-15H
PG8T45.00
45DR59
2247

Hailo
https://hailo.ai

NEW PRODUCTS

MAKE IN INDIA

COMPONENTS

Supercapacitors for automotive use

FMU series high-performance supercapacitors for automotive electronics from KEMET use a proprietary aqueous electrolyte solution that provides high durability against liquid leakage, vibrations, and thermal shock, which improves its reliability even in harsh automotive environments. The capacitors are highly reliable in a wide operational temperature of -40 to +105°C. These miniature supercapacitors deliver extended lifetime, high power density, fast charging, and high reliability for various energy storage applications. The FMU supercapacitors are ideal for automotive applications that require a main power system backup during a power loss, such as ADAS, autonomous vehicles, and central gateway ECUs. These can be employed in equipment ranging from IoT devices, smart meters, medical devices, and industrial computing.

SC
5.5V 334
-P5+ U

Kemet

https://www.kemet.com

Antennas supporting Wi-Fi 7

Antenova has released a trio of high-efficiency antennas for Wi-Fi 6 and Wi-Fi 6E devices that will offer support for the upcoming Wi-Fi 7 standard. The antennas include a surface mount antenna named Billi SR43W078, a flexible antenna called Lotti SRF3W077, and an external antenna called Nitida SRE3W084. All three antennas have high efficiency and are simple to add to a product since they don't require a matching network. All three use the 2.4GHz, 5GHz, and 6GHz bands and support IEEE standards 802.11a/b/g/j/n/ac/ax. These antennas will deliver better online experiences and support simultaneous communications to many endpoints with increased security. The antennas will enable users to play high-quality content, such as supporting 4K and 8K video streaming, networked gaming, video calling, etc, without any lag, using wireless connectivity. They can be employed in gaming consoles, set-top boxes, surveillance cameras, networked IoT devices, etc.

antenova
SR43W078

Billi SR43W078 | Lotti SRF3W077 | Nitida SRE3W084

Antenova

https://www.antenova.com

Sensor for surveillance cameras

Omnivision OSO4D is a 2K complementary metal oxide semiconductor (CMOS) image sensor for consumer security and surveillance applications. The camera sensor comes in an 8.4mm optical format and has an image resolution of 4 megapixels. It features a 2.0-micron, high-performance backside illuminated pixel, enabling the camera to capture images with higher sensitivity, ultra-low noise, and better overall image quality. The OSO4D image sensor is power-efficient and offers an improvement of over 30% in signal-to-noise ratio when compared with its predecessor. It will enable designers to provide security with better video quality and long-lasting battery run time. Its higher frame rate will enable it to capture high-quality videos and still images of fast-moving objects. Furthermore, it will enable security cameras to have clearer images in darker environments. The image sensor is suitable for use in both analogue and IP cameras, and can be used in cameras meant for smart home surveillance, doorbells, and baby monitoring devices.

Omnivision

https://www.ovt.com

Sound driver IC

PAM8906 from Diodes Incorporated is a new driver IC that enables designers to improve the output from piezoelectric sounders. The PAM8906 can produce louder sounds that can be carried over longer distances by integrating a synchronous boost converter in the IC. This driver also integrates functionality that prolongs its battery-powered operation. The sound driver operates with either an external pulse width modulation (PWM) input or in self-excitation mode, thus providing greater application flexibility and allowing support for an increased variety of sounders. The PAM8906 has three output voltage variants: 20VPP, 24VPP, and 36VPP. This enables the creation of different output versions of the same system. It will enable designers to build low-power compact devices with high volumes. The PAM8906 driver IC is suitable for use in smoke/gas/water alarms, air humidifiers, handheld GPS devices, industrial security alarms, medical

DIODES
PAM8906

devices, and home appliances.

Diodes Incorporated

https://www.diodes.com

Organic indoor solar cells

The Epishine OneCell is an innovative solar cell composed of organic and non-toxic materials. It is capable of maintaining good output power, even with cut-outs in the surface, enabling new types of light-powered applications with customised layouts. The OneCell can be adapted to various surface finishes, such as soft touch plastics, leather, and brushed materials, and can thereby be seamlessly integrated into devices made with these materials. It is available in sizes ranging from 20cm^2 to 300cm^2, making it adaptable for a wide range of applications. The OneCell will enable designers to integrate high-efficiency solar cells directly into the low-powered IoT devices, irrespective of their shape.

Epishine

https://www.epishine.com

3D depth sensing camera

e-con Systems DepthVista MIPI IRD is a 3D Time of Flight (ToF) camera for NVIDIA Jetson AGX Orin/AGX Xavier. The camera has a scalable depth range of up to 12 metres with an accuracy of over 99%. It features a wide spectral range, which makes it suitable for both outdoor and indoor embedded vision systems. Moreover, the camera can avoid complications like running depth-matching algorithms on the host platform. The DepthVista MIPI IRD will enable designers to use it as a robust depth-sensing camera that can also be used in harsh outdoor environments. It can be used in applications such as autonomous self-navigating delivery bots, robo vacuum cleaners, etc.

e-con Systems

https://www.e-consystems.com

Switching regulators

RECOM R-78Kxx is a series of high-efficiency, 3-terminal switching regulators. It is a replacement for the company's existing 3-terminal, TO-220 style linear regulators and offers saving of energy, board space, and cost, by eliminating heatsinks and their assembly overheads. The R-78 series can work with input voltage up to 36V and offers an efficiency up to 96%. The R-78K series features under-voltage lockout and short-circuit protection with automatic recovery and can meet EN 55032 class B EMC specifications with a simple input filter. The 0.5A and 1A rated versions are in a SIP-3 miniature package, with a footprint of 11.5mm × 7.55mm and a height of 10.2mm, while the 2A version is in a 11.5mm × 8.5mm footprint and 17.5mm height, again in a SIP-3 arrangement. The switching regulators are rated for temperatures up to 90°C with no derating.

RECOM Power

https://recom-power.com

Monolithic programmable delay lines

3D7428
3D7424
3D7428

Omni Pro Electronics has announced new 4- and 8-bit monolithic programmable delay lines for data delay devices. Both these devices use an all-silicon CMOS technology and are vapour-phase, IR, and wave solderable. Temperature stability is typically ±1.5% (-40 to +85°C). The 4-bit 3D3424 and 3D7424 devices have four independent programmable lines on one chip and have a low quiescent current (5mA typical). They both have delay tolerance of 3% or 2ns, line-to-line matching of 1% or 1ns typical, and a minimum input pulse width of 10% of total delay. The 8-bit 3D3428, 3D3438, 3D7428, and 3D7438 are programmable via serial or parallel interface and have a delay tolerance of 0.5% and typical supply currents of 2mA or 3mA. The 3D3428 and 3D3438 have 3.3V CMOS compatible inputs and outputs while the other two have TTL/CMOS compatible inputs and outputs. These digitally programmable lines are used in medical imaging, industrial, aerospace, and other timing-critical applications.

Omni Pro Electronics

https://www.omnipro.net

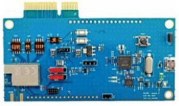
EMBEDDED

Wi-Fi modules development kit

The DA16200 is an ultra-low-power Wi-Fi modules development kit from Renesas that includes support for the new Matter protocol. It employs a DA16200 system-on-chip (SoC), which is the world's first Wi-Fi SoC to deliver year-plus battery life for always-connected Wi-Fi IoT devices. The Renesas development kit can solve the problem of interoperability for smart home In-

WE LOVE TO SHOWCASE NEW PRODUCTS!

Launched a New Product related to electronics?
Share its details with us at newproduct@efy.in
Send a photo too. We will be happy to
review it, and if it matches our guidelines—
we will publish it here, for FREE!



ternet of Things (IoT) devices by enabling the connection of different smart IoT devices with each other, irrespective of the manufacturer. DA16200 is both robust and cryptographically secure, making it suitable for both residential and industrial applications. It is fully integrated into Renesas' E2Studio for easy system development using Renesas MCU, connectivity, and other devices. The kit will simplify the development process, reduce the development cost, and enable faster time-to-market for IoT devices.

Renesas

https://www.renesas.com

Turnkey optical module

Teledyne e2v's Optimom 1.5M is a 1.5-megapixel turnkey optical module added to the company's Optimom series. It features a CMOS image sensor capable of capturing images at a resolution of 1920 × 800 pixels. The Optimom 1.5M comprises a proprietary image sensor, a tiny 25mm square board with lens mount, and an optional lens in various options. The module features a native MIPI CSI-2 protocol and comes with a complete development kit, which includes an adaptor board, cabling, and Linux drivers for instant integration with MIPI based processing units, such as NVIDIA Jetson or NXP i.MX solutions. The new module can help designers to reduce development time and cost for embedded vision and AI vision solutions. The resolution of the sensor makes it suitable for applications such as laboratory equipment, handheld scanners, auto ID systems, and use as a drone camera.

Teledyne e2v

https://www.teledyne-e2v.com

Vision processors

Scalable processing performance for edge AI vision-based designs with up to 12 cameras
Texas Instruments

Texas Instruments (TI) has released a new family of six Arm Cortex based vision processors that allow designers to add enhanced vision and artificial intelligence (AI) processing. This new family includes the AM62A, AM68A, and AM69A processors that can bring intelligence from the cloud to the real world by eliminating cost and design complexity barriers when implementing vision processing and deep learning capabilities in low-power edge AI applications. These processors feature a system-on-a-chip (SoC) architecture that includes extensive integration. Integrated components include Arm Cortex-A53 or Cortex-A72 central processing units, a third-generation TI image signal processor, internal memory, interfaces, and hardware accelerators that deliver from 1 to 32 tera operations per second of AI processing for deep learning algorithms. They are supported by open source evaluation and model development tools and common software that is programmable through industry-standard application programming interfaces, frameworks, and models. The ARM based vision processors can reduce cost and complexity of development. These can be used in a wide range of applications, such as video doorbells, machine vision, and autonomous mobile robots.

Texas Instruments

https://www.ti.com

Automotive wireless microcontroller

Onsemi NCV-RSL15 is an ultra-low-power automotive-grade wireless microcontroller with Bluetooth Low Energy connectivity. It is the industry's lowest power, secure microcontroller featuring the proprietary smart sense power mode. It can enable wireless connectivity, which can help vehicle manufacturers to reduce the cost and weight of the system by eliminating excess cabling required for sensors and in-vehicle communication. The NCV-RSL15 offers enhanced security with Arm CryptoCell featuring hardware based root-of-trust secure boot, many user-accessible hardware-accelerated cryptographic algorithms, and Firmware-over-the-Air capabilities to enable future firmware updates and deployment of security patches. The microcontroller addresses heightened security concerns resulting from more sensors and with that more possible attack vectors. The NCV-RSL15 will enable designers to add more sensors while reducing the wiring size, time of development, and cost of the upcoming vehicles.

Onsemi

https://www.onsemi.com

Compact standalone Wi-Fi module

u-Blox IRIS-W1 is the first compact standalone Wi-Fi module combining dual-band Wi-Fi 6, Bluetooth LE (Low Energy) 5.3, and Thread including support for Matter. The IRIS-W1 is powered by an Arm Cortex-M33 MCU that eliminates the need for an external processing unit. It comes in four variants, each enabling the user to select among various antennas and software environments. The module also enables users to select Wi-Fi channels from the 2.4 and 5GHz spectrum. It enables the engineers to create products that offer higher availability of network and throughput, less data congestion in dense environments, and lower network deployment costs. Its design makes it compatible with battery-operated devices. With its support for Matter over Thread, Wi-Fi, and Ethernet, this module provides the key technologies for intelligent buildings, smart homes, etc.

u-Blox

https://www.u-blox.com

Development kit for IoT

Synzen Precision Technology has released a new development platform that uses the advanced capabilities of the Nordic nRF9160 module. The development platform features a new LTE solution, which eliminates the requirement of switching networks, thus reducing costs, complexity, and size of the product. The whole module comes in a small form factor, measuring just 50mm × 50mm. The development platform offers security features to ensure protection of transmission of sensitive data, making it suitable for a wide variety of IoT applications. This new platform is designed to simplify the creation and deployment of IoT projects while ensuring seamless connectivity and secure data transmission.

Synzen Precision Technology
www.synzen.com.tw

Bluetooth SoC

Silicon Labs has released the xG27 family of Bluetooth system on chips (SoC) for small form factor IoT devices. The SoC is based around the ARM Cortex M33 processor and features an integrated DC-DC boost converter, allowing it to work with voltages as low as 0.8V. It also features an integrated coulomb counter, which enables it to measure the battery state to help users avoid battery depletion during use, thus improving user experience and product safety. The SoC offers IoT device designers energy efficiency, high performance, trusted security, and wireless connectivity. The SoC is ideal for use in tiny, battery-optimised devices like connected medical devices, wearables, asset monitoring tags, smart sensors, and simple consumer electronics like toothbrushes and toys.

EFR32xG27
2.4 GHz
8 dBm, DCDC Buck
QFN40
SILICO

Silicon Labs
https://www.silabs.com

Multi-function wireless thermostat

MClimate's has released a connected thermostat that measures movement, humidity, temperature, and illuminance. The standalone thermostat is powered by Epishine's organic indoor solar cell. The device features a 7.4cm e-ink screen, sensor for movement (PIR), temperature and humidity sensor, LUX sensor, and 3 buttons. The PIR sensor enables the device to detect any movement and control the temperature or humidity of the room. The device can send uplinks after any event or at predetermined intervals. It can be powered by 4 AA batteries or by connecting USB-C, if it needs to be installed in a dark room. The MClimate wireless thermostat can enable energy usage optimisation, thus making buildings smart at a low cost.

MClimate
https://mclimate.eu

SiP for IoT applications

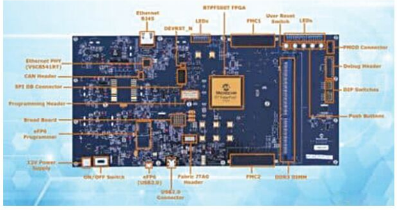
The iMCP HTLRBL32L system-in-package (SiP) from HT Micron can enable communication to an IoT solution. It combines Bluetooth Low Energy and LoRa to enable easy integration and prototyping of long- and short-range IoT solutions. The product comes in a small package measuring just 13mm × 13mm × 1.1mm. The low-power solution can enable IoT devices to work for years on a single battery charge. It features an accessible MCU and internal memory, and a full range of interfaces for analogue and digital peripherals. It also provides high configurability and flexibility for IoT applications. The SiP can enable designers to build low-cost, low-power, compact IoT solutions that can find application in several fields, including smart farming, smart building, and smart logistics.

HT MICRON
HTLRBL32L-10
2021
10HT8GB14R18

HT Micron
www.htmicron.com.br/en

Development kit for space applications

The RT PolarFire development kit is an integrated development platform that combines Microchip's flight-ready RT PolarFire FPGA with the development kit and interfaces. The development platform is suitable for evaluating design concepts based on actual in-flight electrical and mechanical characteristics. To enable the designers to evaluate high-speed transceivers and test all of their control, DSP, communications, and image-processing algorithms, the kit employs the same package and silicon that final in-orbit or deep-space units will have. The FPGA increases mission-critical computing and connectivity throughput compared to SRAM FPGAs while consuming up to 50% less power and offering greater immunity to radiation-induced configuration single event upsets. This platform will enable designers to solve difficult spaceflight challenges as reducing satellite signal processing congestion. Moreover, it will enable designers to prototype with the same low-power, high-throughput radiation-tolerant (RT) FPGA that will be used in spaceflight.

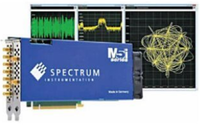


Microchip Technology
www.microchipdirect.com

T&M EQUIPMENTS

PCIe digitizer cards

Spectrum Instrumentation has added M5i.3350-x16 and M5i.3357-x16 PCIe digitizer cards to the company's flagship M5i series. The cards can turn any PC it into a powerful measurement tool by installing them in a suitable PCIe slot. This allows the users to use the latest CPU and GPU hardware for signal processing and analysis. Both PCIe digitizers deliver optimal GHz signal acquisition and analysis capabilities. The one- and two-channel cards offer a stunning combination of ultrafast 10GS/s sampling speed with 12-bit vertical resolution and 12.8GB/s data streaming (over the PCIe bus). The cards feature front-end circuitry with over 3GHz bandwidth and up to 16GB (8GSamples) of on-board memory. The PCIe digitizer cards are ideal for users who need to perform data intensive processing, like continuous averaging for noise reduction, or MPoint-FFTs for spectral analysis.



Spectrum Instrumentation
https://spectrum-instrumentation.com

RF power measurement sensors

R&S NRP90S(N) from Rohde & Schwarz are diode power sensors for power measurements up to 90GHz frequency. The new instruments offer a frequency range of 50MHz to 90GHz with a dynamic range from -70dBm to 20dBm along with high measurement speeds of 50,000 per second. The higher measurement frequency of sensors allows the instruments to cover the latest spectrum allocation for 5G FR2-2 up to 71GHz, satellite communications in both the 71GHz to 76GHz band and the 81GHz to 86GHz band, automotive radars operating from 76GHz to 81GHz, as well as other lower frequency wireless transmission technologies. The NRPxxS power sensors have a portable form factor and flexible operating modes that makes them suitable for both local and remote installation in maintenance or monitoring applications. It also enables high-speed power measurements for all frequencies above 67GHz in 5G, automotive radar, and satellite communications applications, including the entire E band.

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MISCELLANEOUS

Edge-AI developer cloud

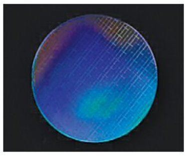
STMicroelectronics has unveiled the world's first microcontroller (MCU) edge-AI developer cloud. The STM32Cube.AI developer cloud opens access to an extensive suite of online development tools built around the STM32 family of MCUs. The STM32Cube.AI desktop front-end includes the resources for developers to validate and generate optimised STM32 AI libraries from trained neural networks. The STM32Cube.AI, which is an online tool, offers interface to generate optimised C-code for STM32 microcontrollers, without requiring prior software installation. This new tool brings the possibility to remotely benchmark models on STM32 hardware through the cloud to save on workload and cost. It opens access to the STM32 model zoo, a repository of trainable deep-learning models and demos to speed application development. The tool can be used for various use cases, including human motion sensing for activity recognition and tracking, computer vision for image classification or object detection, and audio event detection for audio classification.

STM32
Cube.AI

STMicroelectronics
https://www.st.com

Quantum software development kit

Intel has released their quantum software development kit (SDK) version 1.0 to grow the developer ecosystem. The SDK is a full quantum computer in simulation that can also interface with Intel's quantum hardware, including Intel's Horse Ridge II control chip and the upcoming Intel's quantum spin qubit chip. The kit allows developers to program quantum algorithms in simulation, and it features an intuitive programming interface written in C++ using an industry-standard low-level virtual machine (LLVM) compiler toolchain. As a result, Intel's SDK offers seamless interfacing with C/C++ and Python applications, making it more versatile and customisable. The Intel Quantum SDK helps programmers get ready for future large-scale commercial quantum computers. It will help developers learn how to create quantum algorithms and applications in simulation.



Intel
https://www.intel.com

Printed electronic kit for IoT

Henkel INKxperience is a novel sensor experience kit tailormade for IoT engineering across industries. The novel Henkel Qhesive Solutions Sensor INKxperience kit offers four different printed electronics technologies that are pre-configured with hardware and software for prototyping and engineering ideation. The kit has been designed for professional engineers to help them quickly and efficiently explore and experiment with the technology of printed electronics for the development of IoT sensor solutions. The kit contains four different technologies, including a leak detection sensor, a non-contact liquid level sensor, a positive temperature coefficient heater, and a single- as well as multi-zone force sensitive resistor sensor, which are all reusable multiple times. The printed technologies are pre-configured with hardware and software for immediate and continuous data readout and offer an easy setup for the ideation of new ideas and proof of concept during prototyping and the engineering process of next-generation IoT sensors.

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The Shape Of Things
TO COME FROM JAPAN

NEPCON Japan is a good bet if you want to catch a glimpse of what's new in electronics. While NEPCON focuses on electronics manufacturing equipment, its co-located shows, which are related to electronics too, provide the holistic picture of what's hot and what's not. Rahul Chopra, Editor, Electronics For You, happened to visit the show and could not stop himself from sharing some key trends that stand out

RAHUL CHOPRA

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The B.iRON: Soldering iron with battery

Automotive electronics

The expo space devoted to automotive electronics in NEPCON Japan been growing over the years. I remember seeing it occupy a fraction of a hall a few years ago. Now, automotive electronics was spread across three halls!

Electric vehicles (EVs) and hybrids are driving this market for sure. The latest sensors, power management ICs, connectors, etc used in such vehicles were all being showcased.

> This year's highlight at NEPCON Japan, at least for me, was the presence of a couple of large booths of Indian firms. Two that stood out were of Tata Consultancy Services (TCS) and Asti Electronics. Both were professionally designed large booths—not the ones you get with government subsidy. Both of them had staff members who spoke Japanese language fluently. I have been visiting NEPCON Japan since 2017, but this was the first time I got to see such booths from India, which was of course a matter of pride!

But what stood out was the Software Defined Automotive section, where one could see the typical IT-type brands exhibit their wares in an 'electronics' show. Microsoft and AMD-Xilinx were there in a big way, and so was India's IT giant, TCS. The conference on the same theme made you realise how 'digital twins' and the related concepts were going to define the future of automotives.

Soldering irons' incarnation

A major surprise for me was to find soldering irons displayed in the expo, which I thought had become a boring item by now. But the soldering irons displayed there turned out to be 'hotter' than I could ever imagine.

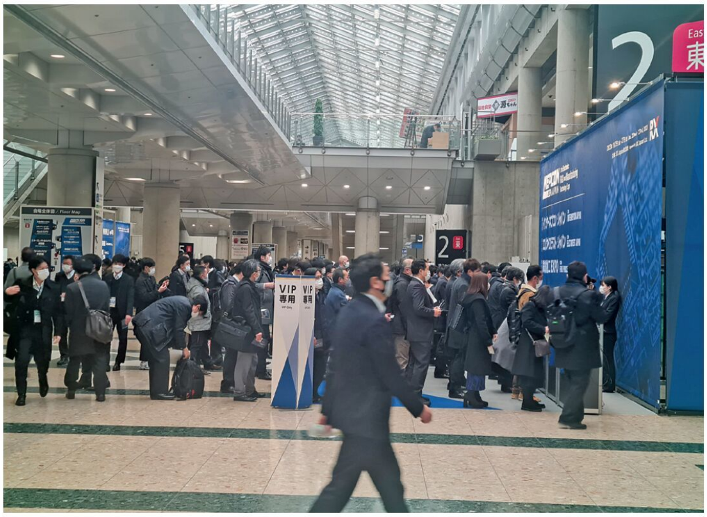
JBC brand was the first to catch my eyes with their wireless soldering iron (B.iRON) that runs on a battery. A further surprise was its super cool stand, where you could place the iron and simultaneously charge it. To me it looked like a must-have item for electronics enthusiasts. Whether such soldering irons would become popular on shopfloors too is anyone's guess for now.

The next one that caught my attention was a Japanese offering called Senpujin. Launched by Shoritsu Electric, the soldering station has an air-suction cleaning system. Since the need to rub the soldering tip has been eliminated here, it promises a much longer life for the soldering tips. Plus, the cleaning is ultra-fast, which could result in a higher productivity for your team. They don't have any distributors in India, yet.

The Senpujin: Soldering iron stands with air-cleaners

Packet sorting robots

Vertical stacking robots



Visitors' registration area

The TCS booth

Autonomous robots

Whenever the words 'electric vehicles' or 'autonomous vehicles' were uttered, I would imagine these were related to cars, two-wheelers, or trucks. But the co-located shows on Smart Logistics and Smart Factory made me realise that the smart robots managing the warehouses and factories are the real growth market for such tech—at least currently.

Smart robots are the vehicles that are electric, autonomous, and becoming super-smart. They are being developed and deployed in all shapes and sizes. There are 30cm tall robots that sort and place packets with ease. There are bigger ones that pick components from the storehouse and place them in the machines that consume them to manufacture products.

There are also those that go up and down the warehouse storage racks, pick the right container, and bring it down to pass on to another guy (again a robot), who takes it to the right destination. And, then there are the strong ones that can pick the whole rack (filled with inventory) and move the entire rack from one place to another. Phew! Just seeing them all work together was mind-boggling.

I can go on with the wonderful new tech I saw at NEPCON, but these three trends were the ones that stood out. EFY

Rahul Chopra is Editor of Electronics For You and Open Source For You magazines and Managing Director of the EFY Group

MITEL AND AVIENTEK FORGE DISTRIBUTION PARTNERSHIP IN INDIA

Mr Shrinivas Timmanagoudar

Mr Asif Khan

Mr VM Manu

Dubai-based leading value-added distributor of audio-visual (AV) & unified communications, Avientek recently partnered with global business communications leader Mitel, to distribute its various products and applications in India. As a Canada-based, 1973-born company, Mitel connects businesses and service providers, collaborates and communicates innovatively with their customers. Avientek is a leading value added distributor of Audio Visual & Unified Communication products and services in the Middle East, Africa and Indian Subcontinent.

Giving effect to the new collaboration, Avientek hosted 4-city roadshows in association with Mitel. Senior management from both the partner companies was present at the events held in Bangalore, Chennai, New Delhi and Mumbai in the 4th week of February 2023. Various industry dignitaries also graced the symposium with their presence.

At the events, Mitel showcased its vast product and solution range and the partners briefed the gathering about their globally-available services. Professionals from both companies presented their solutions to the gathering, which was followed by a Q&A session. Both parties were utterly optimistic about the collaboration.

In addition to the welcome note delivered by Avientek's Regional Sales Managers, Pankaj Sinha in Delhi, Dhiraj Patil in Mumbai, and Rajaram in Chennai, the company's country head, Shrinivas Timmanagoudar introduced Avientek. Mitel's Channel Director for the Middle East & Africa, Mr Asif Khan put forward the insights, Go To Market strategy and the extensive partner program for India. Afterwards, the senior channel account manager of Mitel, Mr Nooruddin Siddiqui provided a solution overview and demo to the attendees of the symposium.

I got an opportunity to chat with Mr Asif Khan , Avientek's Director, Mr VM Manu and Avientek country head Mr. Shrinivas Timmanagoudar and learnt more about the new alliance, its extent, its intent and its after-effects. In addition, the future course of action of both companies was extensively discussed. Here's an excerpt:

Q. Why did you choose to partner with Avientek?
ASIF KHAN. When we started the Indian operations, we were looking for a very strategic partnership in distribution. So, the first objective was to identify the right distribution partner who is available on the ground, and who can add value to our global perspective.

As a part of Mitel's global policy, a partner with a good understanding of the channel model, pre-sales support, operations and logistics efficiency, and credit and financing was needed. They must also have good sales so that they can work as an advisor.

We looked at many potential distribution companies in India and analysed their model and the value proposition they offer to channel partners. We did it because, ultimately, the distribution is going to represent the vendor i.e., Mitel in India. We found that Avientek has all the ingredients that we were looking for and it can drive the regional strategy with a global mindset.

Q. Mr Manu, same question for you, why'd Avientek choose to sign this deal with Mitel?
VM MANU. Avientek is a well-known name in the distribution industry, mostly in the audio-visual and extended segments. We have partnered with a large number of companies across the region. In recent years, the differentiation between audio-video, telecom and IT is getting blurred and is becoming a single platform.

On the other side, Mitel is a global leader in business communication with a stronghold in call centres. It is well-known that India is a preferred location for a back office for a number of industries. So, since a large number of call centres are running here already, and many people are working in hybrid mode, especially after COVID, it gave us the impression that a strong communication platform is needed, with unified communication, call centres, and collaboration altogether. As Mitel is one of the world's strongest players in that segment, we chose Mitel. I'm sure that the partnership would be a great success in the market.

Q. What is the exact geographical parameter of this agreement?
VM. Right now, we have signed the deal with a pan-India mindset. To support that, we have our sales team across the region, covering almost the whole of India geographically. We have our team working in Delhi, Calcutta and Chennai. We also have our office and experience centre in Mumbai and Bangalore.

Our primary focus will be on the telecom industry. At the same time, we are focusing on good audio-visual companies so as to bring them to our side of the telecommunication and collaboration segment.

Q. Mr Asif, you have hired teams in Bangalore, Mumbai and Kolkata, but not in the North of India. Any specific reason for that?
AK. We look at the entire Indian market as one but we had planned two phases, wherein we'd have gone for two headcounts in each phase. But luckily, we got three people, and we went forward with that strategy. Of course, we have realized that the south has got a lot more addressable markets like Chennai, Hyderabad, and Bangalore. Then, Kolkata has a lot of government work, especially in the railway sector.

Nonetheless, Avientek and Mitel have decided to split the resources. Wherever Mitel's resources are present, Avientek will work with its local team. But, if Mitel's resources are not there, Avientek will come out with a complete, dedicated team. So, Mr Pankaj from Avientek is a resource for Mitel for North India. But yes, gradually, we will build a bigger team also.

Q. How did Mitel manage this part of the world prior to the current agreement?
AK. Mitel is operating in more than 100 countries and has a global presence. But the Indian market was managed by our APAC (Asia Pacific) regional team, headquartered in Singapore. It also managed the ANZ, i.e., Australia, New Zealand and Singapore region along with managing the Indian operation. But after doing some internal realignment, we realized that we can utilize our Middle East resources, strength and experience in India. Some of the competitors are having a similar structure as well.

Since we wanted to serve the Indian market better, we moved our APAC team from there and connected them with the Middle East operation and here we are today!

Q. People are wondering why Mitel has become more aggressive than ever in recent times. What would you like to comment on this?
AK. We found some gaps in our strategy and we are trying to bridge them. That's making us look aggressive and that's fine. India is a very big region in terms of its potential and the addressable market, and it is continuously growing. We want to be a part of this journey. That's all we are at. That's why we are making these kinds of investments in the market. Put together Avientek and Mitel, we are going to have almost 10 people on the ground in India.

Q. What benefits do both of the companies seek out of this partnership?
AK. The benefits are threefold. The first benefit is growth. Mitel is growing in double digits YoY, and we need to replicate the same in the Indian market also. We want to go very aggressive.

Secondly, we are looking for customer acquisition in various segments. When revenue growth comes, it will definitely bring customers as well. For the last few years, Mitel has been going for verticalization of our strategy and we see vertical as our way forward—we want to get into hospitality, government, healthcare etc.

So, the trio of verticalization, customer acquisition and revenue is what we are looking at and distribution is going to play a very important role in getting this strategy in place.

Shrinivas Timmanagoudar. Avientek is one of the youngest and fast-growing distribution companies in India in recent times. We have distributions and AV partners across India. What we get on board with the Mitel partnership are the telecom partners. That's what we are looking at in the long term.

In India, we want a 360-degree approach. Today, we are an AV company and now we are going to telecom, so the next step would be IT. By forging partnerships like these, we're covering the whole industry with respect to what we provide. Tomorrow we can easily distribute any product across India as we will have a good reach. That'll take our revenue to higher levels and as per our revenue plan, we are hoping for an aggressive push to revenue, if not simply double the numbers for the next three to five years. At the same time, we are increasing our portfolio plus the geographical presence with new resources for each region.

And as Mitel has a legacy of around five decades, it is a stable company. So, even though we see a lot of rejig in the telecom industry, we increase our credibility in the market by aligning with a stable company.

Mitel
Powering connections
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Q. Which products and solutions are they going to distribute?
AK. Mitel has a complete portfolio addressing the horizontal as well as vertical needs of our customers. Horizontally speaking, we have a platform for very small-medium businesses to very large corporations and vertically, we have solutions fit for all purposes including hospitality, government and technology verticals like contact centres, banks and related segments. Avientek is going to distribute all our products and end-to-end solutions. In fact, we are going to add new products for the Indian market, such as some of the cloud offerings. Currently, we are evaluating all those propositions, from the government as well as from the legal perspective.

Q. What values do you aim to bring to this partnership?
VM. When it comes to Avientek, we always take the forward call to support our partners. We do it in multiple ways like now, we are extensively investing in demo centres where our partners can do the hands-on testing. Moreover, the partners can bring the end users to have first-hand experience in our test environment. Also, we ensure that every serious partner is having a demo system in their facility to provide the best support to the customers.

Furthermore, we take some of the load off the shoulders of our partners. Like with Mitel, we keep the stock. So, the partner will be able to focus more on their activity like finding new customers, providing the right solution etc. Then obviously, we support the partners on the financial side based on the relationship providing all kinds of credibility.

Q. Are there any specificities in these countries in terms of business needs? What does the market look like here?
AK. Mitel is looking at markets in various continents and countries based on multiple parameters—the first being the potential of the country. It is measured in terms of the addressable market. India definitely has a major TAM, the total addressable market in communication or the business that we are in. Secondly, we look at the political environment, and we found that India is quite stable in that perspective. The third is the financial situation, especially inflation and the Forex. A lot of countries are facing high inflation. I think that is not a problem with India.

Apart from these three things, we also realize that certain international operators, especially in the hospitality domain, are making investments in India and Mitel is very strong in hospitality. So, we found that India is the right fit for us with a high potential.

Q. To what extent do you believe Mitel solutions and Avientek answer the needs of organizations in India?
AK. As one of the global leaders in business communications with 50 years of experience in more than 100 countries, we're quite convinced that we're able to meet the needs of organisations based in India with our solutions. And partnering with Avientek will allow us to have the local footprint and the support needed by partners to best serve their customers.

You Can BET YOUR FARM On IT

Technology can aid farmers overcome problems ranging from climatic changes to demand fluctuations. However, the uptake by small farmers is still low, despite the range of affordable solutions available. How can Indian agri-tech startups reach the masses?

PM Modi flagged off 100 kisan drones last year, to encourage their use in farms for spraying herbicides, carrying loads from farms to markets, and so on (Courtesy: https://cdn.dnaindia.com)

JANANI G. VIKRAM is a freelance writer based in Chennai, who loves to write on emerging technologies and Indian culture. She believes in relishing every moment of life, as happy memories are the best savings for the future

The world today is faced with a three-pronged problem—increase in population and food insecurity; decrease in supply of agricultural produce as an effect of global warming, consequent climatic changes, and natural disasters; and rise in greenhouse gas emissions by agricultural and food production sector further contributing to global warming. This vicious cycle can only be broken by what global entities have termed as 'climate-smart agriculture.'

The World Bank defines Climate Smart Agriculture (CSA) as "an integrated approach to managing landscapes—cropland, livestock, forests, and fisheries—that addresses the interlinked challenges of food security and climate change." CSA aims to enable the agricultural sector to produce more and better quality of food; be more resilient to problems like climatic changes, natural disasters, pests, and market eccentricities; and to reduce the carbon footprint per calorie or kilo of food produced, by reducing wastage, improving efficiency, avoiding deforestation, and finding ways to absorb carbon out of the atmosphere.

"Agricultural practices are being significantly transformed by emerging technologies. Timely prediction of crop readiness, crop-related diseases, and

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integrated demand-supply systems are essential for the Indian agricultural economy to grow. All this and more are achievable by what Intel's CEO Pat Gelsinger calls the five superpowers—ubiquitous computing, pervasive connectivity, cloud-to-edge infrastructure, sensing, and artificial intelligence. The implementation of these technologies has the potential to enable Indian farmers to adopt more sustainable and cost-effective farming practices, while also facilitating climate-smart agriculture. To accelerate the adoption of smart farming practices, we need to build Digital Readiness amongst farmers and the aligned ecosystem, enabling them to learn new tech skills, trust new technologies, and enhance the ability to use these superpowers responsibly and effectively for socio-economic benefits," says Shweta Khurana, Senior Director - APJ, Government Partnerships & Initiatives, Global Government Affairs, Intel.

However, despite these benefits, the adoption at the grassroots level is still low. Rajesh Jalan, Chief Technology Officer, Cropin, says, "India is moving ahead with the adoption of smart farming technologies. Sensors and Internet of Things (IoT), automated irrigation, satellite imaging, and drone monitoring are already being used by sections of the agricultural sector—specifically corporate-supported farms, co-operatives, and large-holder farmers. However, compared to the size of India's farm sector and the number of farms and farmers, the level of adoption is still low."

Transitioning from mere automation to smartness

Agriculture still sustains on traditional wisdom—and there are no second thoughts about that. However, it looks like farmers could do with a little technological help to deal with the changing (or challenging) environmental and market forces. Automation, with a good dose of intelligence, all strung together as a smart farming platform, could assist a farmer—and consequently the society—in several ways.

TartanSense robots help farmers with tasks like weeding, picking, and spraying (Courtesy: TartanSense)

Machines. Robots, drones, and other machinery help automate several processes on a farm. They increase control over processes, reduce errors, improve productivity, and decrease wastage. Robots are used for weeding, planting seeds, harvesting agricultural produce, palletising, and more.

Take the case of fruit harvesting robots—they use sensors to detect the stage of development of each fruit. Then, based on pre-programmed parameters, they pluck only those fruits that are at the right stage of ripeness. They are also made to handle delicate crops with care.

Similarly, smart sprinklers are often used to water crops. They usually work together with sensors that measure moisture levels of air and soil. They compare sensor readings against data about the moisture requirements of the crop, and provide just the right amount of water.

Drones are also handy helpers. They help in tasks like spraying fertilisers, monitoring fields and livestock, and mapping farms. Although it seems like automation will steal people's jobs, in the agricultural sector that is not the case—there is no holiday on a farm, there is work to be done every day. But there is comparatively less labour available in villages today, with more and more people migrating to the cities in search of work.

Sensors. Sensors are a critical aspect of climate-smart farming, enabling several tasks ranging from automated irrigation to soil testing. Sensors are used to measure—and thereby control several aspects of a farm ranging from soil quality, light, and humidity, to movement and health of livestock, and much more. Sensors are indispensable in the deployment of smart greenhouses, where crops are grown under controlled environments.

Internet of Things (IoT). The IoT is the networking fabric that brings together the robots, drones, sprinklers, sensors, actuators, and other hardware on the farm. It integrates physical and digital resources, enabling remote monitoring and management of farm activities.

For example, data from sensors may be used to initiate sprinklers wherever moisture content is low, or alert the concerned personnel when this does not happen as programmed. The IoT feeds data from varied in-farm hardware to smart software platforms.

Artificial intelligence (AI). The use of AI marks the shift from mere automation to smart farming. AI turns the data collected by the IoT into actionable insights for farmers.

For example, AI tools can study

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the information from soil sensors, such as nutrient value, drainage capacity, acidity etc, to gauge the health of the soil. It will further augment this with climatic conditions and weather predictions for that region, to suggest appropriate crops, which will give maximum yield in such a soil under such climatic conditions.

It will also take into consideration other factors like availability of seeds in that area, history of pest attacks on such crops in that region, water requirements of the crop versus water table in that region, and so on, before making the suggestions. If required, it may also suggest ways to boost soil health with appropriate nutrients.

Software platforms. Apart from individual software or apps that manage different aspects of the smart farm, we now see the emergence of a new generation of cloud-based, intelligent farm management platforms, which aim to integrate all of the farm's needs. Such platforms are not out of reach of farmers as they are often available on a software-as-a-service (SaaS) model.

Solutions galore—from soil testing to pricing

Agri-tech is often classified as pre-harvest and post-harvest technologies. Pre-harvest involves testing the soil and selecting the right crops, planting, irrigating, spraying fertilisers, monitoring the farm, mitigating pest attacks, and other farming activities.

Post-harvest technologies involve quality checking, food processing, packaging, identifying markets, logistics, pricing, and so on. The goal of technology here is to maximise profit for the farmer, while also solving the problem of food insecurity by matching demand and supply.

Hardware, software, and cloud platforms play a major role in pre- and post-harvest activities. Let us look at some interesting solutions available for Indian farmers.

Agribots. From milking cows to harvesting, threshing, and packing, robots are used for a variety of tasks on farms. Apart from global players like Universal Robots, ABB, Nexus Robotics, Agrobot Harvester, Harvest Crew, and Farmwise, there are several interesting Indian startups also working in this space.

For example, Bengaluru based TartanSense makes robots for weeding, picking, and spraying operations on farms, while Gurugram based Intello Labs makes machines that can quality-check agricultural produce, sort, grade, weigh, and pack them too. Autonomous robots from Hyderabad based XMachines can be used for spraying, weeding, cutting grass, and transplanting saplings from trays.

Drones. According to a report by BlueWeave Consulting, the Indian agriculture drones market is forecast to witness a four-fold increase by 2028, with a projected compound annual growth rate (CAGR) of more than 25% during 2022-28. Small, medium, and large drones with fixed, rotary, or hybrid wings can be used for a variety of purposes like aerial mapping, soil, and field analysis, crop monitoring, health assessment, irrigation, and spraying of nutrients and pesticides.

For example, drones equipped with normalised difference vegetation index (NDVI) imaging equipment employ detailed colour information to determine plant health. According to the report, with a team of two operators, 10 drones can plant 400,000 seeds per day.

Through the Kisan Drone Suvidha, the Indian government is promoting the use of made-in-India drones, with 5-10kg capacities, for crop assessment, spraying natural pesticides and nutrients, and carrying small loads of farm produce to the market. The Department of Agriculture & Farmers Welfare has released the standard operating procedures (SOPs), which provide concise instructions for effective and safe operations of drones for pesticide and nutrient application.

Speaking at an event last year, the Agriculture Minister Narendra Singh Tomar said that the government is promoting the use of Kisan Drones by providing a financial assistance of up to 40% (maximum ₹400,000) for the purchase of individual drones. Plus, to make drone services available to farmers on a rental basis, financial assistance of 40% (maximum ₹400,000) is provided for purchase of drones.

Certain marginalised communities and farmers in remote areas are eligible for a larger assistance. In an effort towards digitisation of land records, the government's SWAMITVA (Survey of Villages and Mapping with Improvised Technology in Village Areas) scheme also uses drones for mapping land parcels in rural inhabited areas.

The Mahindra Group, Garuda Aerospace, Thanos India, General Aeronautics, Aarav Unmanned Systems, Asteria Aerospace, BharatRohan, Dhaksha Unmanned Systems, DroneAcharya Aerial, ideaForge, and IoTechWorld are some of the main contenders in the agricultural drone space today.

Intelligence. Fasal is an IoT based, AI powered intelligence platform for horticulture crops. It captures real-time data from on-farm sensors to deliver farm-specific, crop-specific, and crop-stage-specific actionable recommendations to farmers.

Bengaluru based GramworkX has developed an IoT and AI enabled tool, which helps farmers monitor and optimise the utilisation of water. The solution uses IoT devices and a unique machine learning (ML) algorithm. The company claims that their solution provides a 20-30% yield improvement by enabling precision agriculture and consequent water savings.

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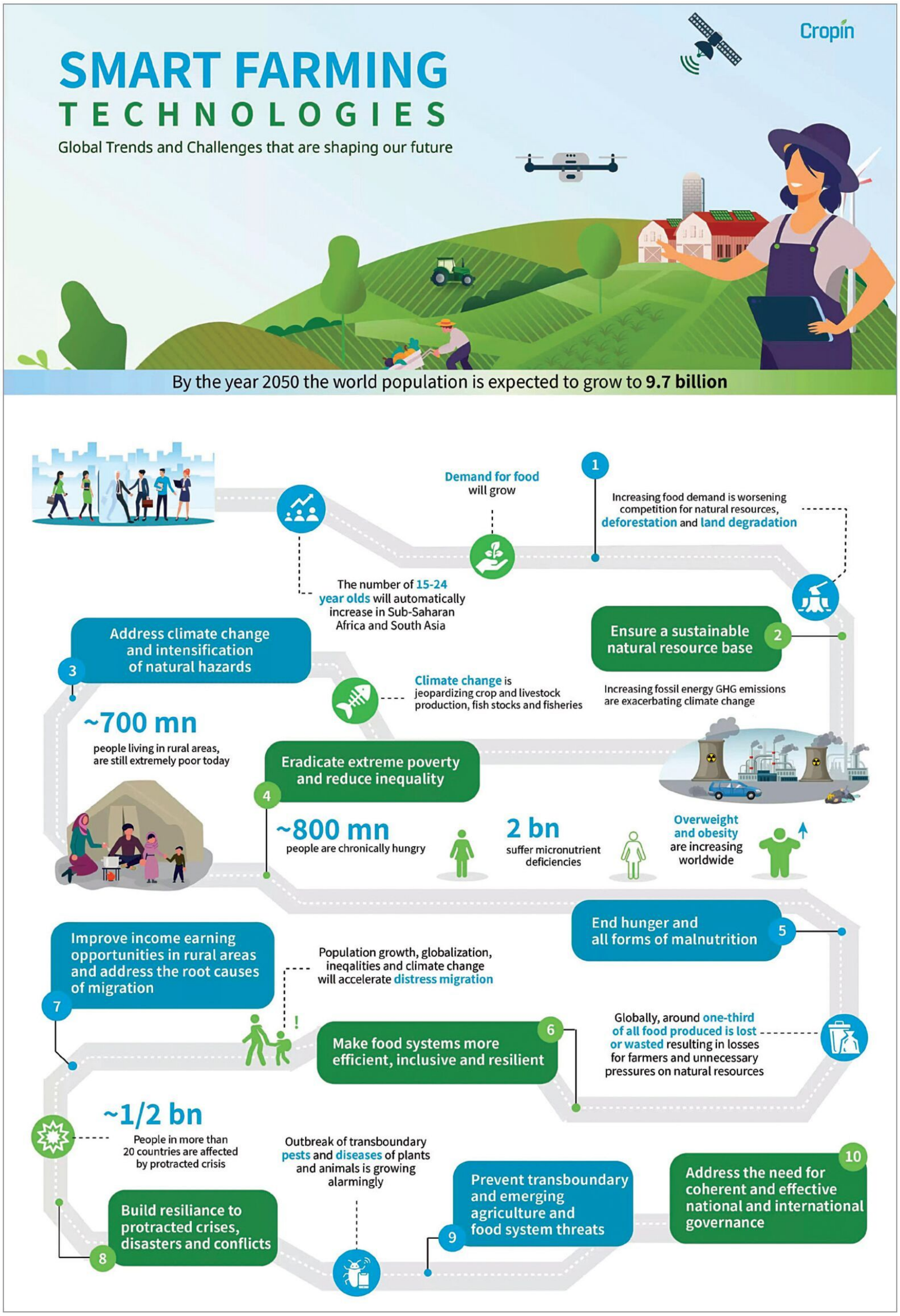
Another Bengaluru based startup, Agdhi, uses a combination of technologies ranging from IoT to machine language and blockchains to detect defective seeds and infected plants. Chennai based Aquaconnect is an AI based, full-stack aquaculture platform that provides farm inputs, market linkage, and financial solutions for shrimp farmers.

Farmonaut and Orbit Field Scout are satellite based crop health monitoring solutions, which warn farmers early about disease outbreaks in crops, pest attacks by locusts, or animal interference. Dhenutrack is an AI based cow management and tracking system incubated at IIT Patna. Fyllo and AgricxLab are other AI based portals to watch.

Last year, Microsoft revealed Project FarmVibes, a new suite of open-sourced, farm-focused technologies from Microsoft Research. The first to be released was FarmVibes.AI, a set of algorithms that run on Microsoft Azure, which can predict the ideal amounts of fertiliser and herbicide a farmer should use and where to apply them; forecast temperatures and wind speeds across fields; inform the farmer when and where he should plant and spray; determine the ideal depth to plant seeds based on soil moisture; and tell how different crops and practices can keep carbon sequestered in the soil. Developers can also enhance these algorithms to suit specific farm needs.

Full-stack. Cropin is a well-known full-stack SaaS solution that helps increase the efficiency, productivity, and sustainability of farms using a combination of technologies ranging from remote sensing to AI, ML, and big data analysis. In September 2022, Cropin announced the launch of Cropin Cloud, a purpose-built industry cloud for agriculture.

Italian confectionary company Loacker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TECHNOLOGIES
Global Trends and Challenges that are shaping our future
By the year 2050 the world population is expected to grow to 9.7 billion
Demand for food will grow
1
Increasing food demand is worsening competition for natural resources, deforestation and land degradation
The number of 15-24 year olds will automatically increase in Sub-Saharan Africa and South Asia
Address climate change and intensification of natural hazards
3
Ensure a sustainable natural resource base
2
Climate change is jeopardizing crop and livestock production, fish stocks and fisheries
Increasing fossil energy GHG emissions are exacerbating climate change
~700 mn
people living in rural areas, are still extremely poor today
Eradicate extreme poverty and reduce inequality
4
~800 mn
people are chronically hungry
2 bn
suffer micronutrient deficiencies
Overweight and obesity are increasing worldwide
End hunger and all forms of malnutrition
5
Improve income earning opportunities in rural areas and address the root causes of migration
7
Population growth, globalization, ineqalities and climate change will accelerate distress migration
Make food systems more efficient, inclusive and resilient
6
Globally, around one-third of all food produced is lost or wasted resulting in losses for farmers and unnecessary pressures on natural resources
~1/2 bn
People in more than 20 countries are affected by protracted crisis
Outbreak of transboundary pests and diseases of plants and animals is growing alarmingly
Build resiliance to protracted crises, disasters and conflicts
8
Prevent transboundary and emerging agriculture and food system threats
9
Address the need for coherent and effective national and international governance
10

Smart farming technologies—trends and challenges (Courtesy: Cropin)

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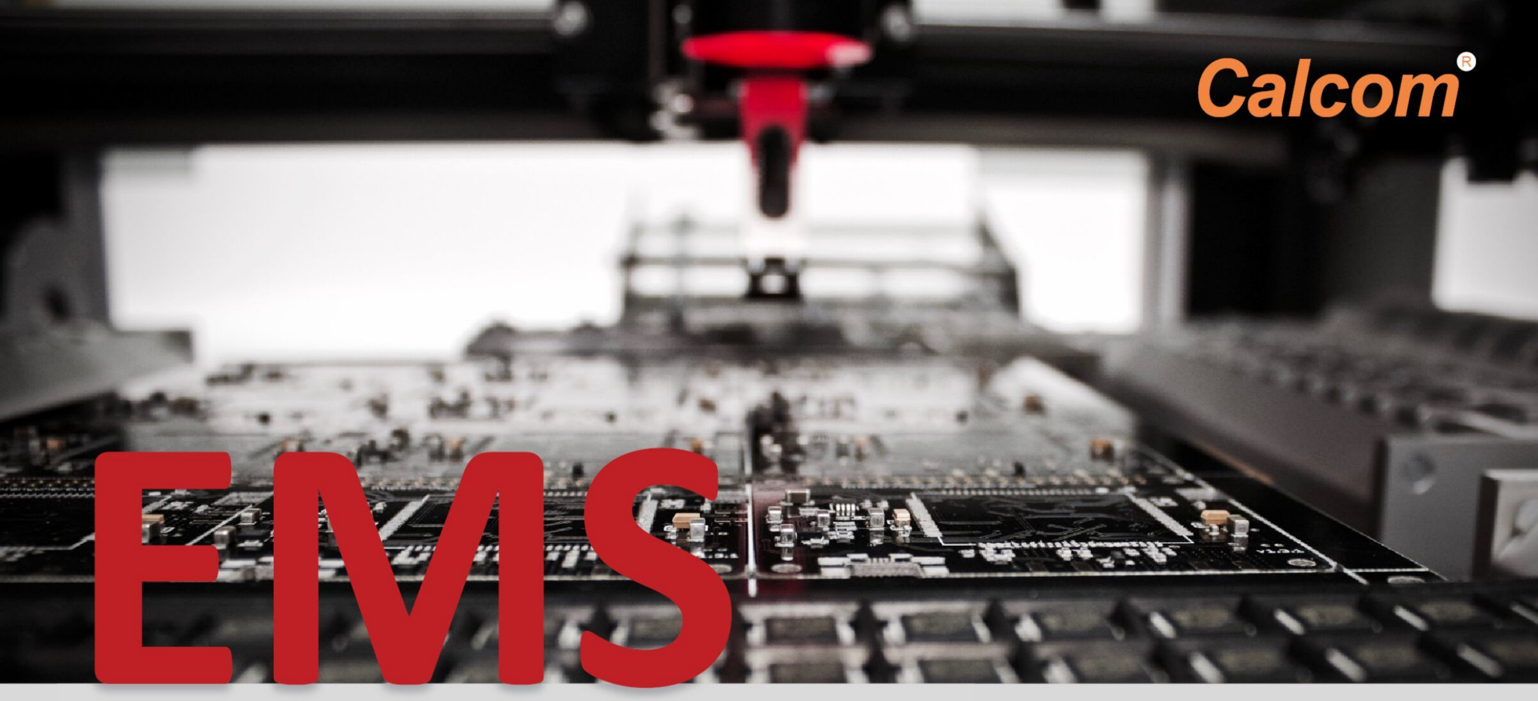

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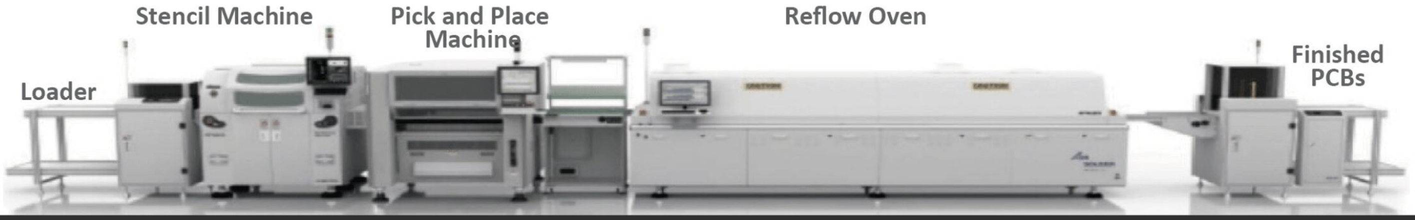

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XMachines' autonomous robot X100 at work in a farm (Courtesy: XMachines)

used Cropin's solution to digitise their hazelnut farms in Italy, while Unilever used it to digitise coconut farms in Indonesia and support the farmers with agro advisories and best practices. A large Indian business conglomerate, which deals with spice farms spread over 35,000 acres, and managed by 10,000 farmers across 170 villages, used Cropin's solution to digitise farmer and farm data, and to geotag it.

Similarly, one of the largest tea corporations based out of India, which produces 10 million kilograms of tea annually, partnered with CropIn to digitise their farm operations covering 50+ plantations and 2500+ acres of area under cultivation. For the Rainforest Alliance, Cropin developed CocoaSense, an AI-powered solution that leverages satellite imagery to efficiently manage cocoa crops in Ghana.

The Sustainable Livelihoods and Adaptation to Climate Change (SLACC) agency of the World Bank partnered with the government of India to improve the livelihoods of smallholder farmers. Cropin was chosen as a technology partner for this project, which aimed to provide climate-resilient agriculture to farmers in four flood and drought-affected districts in Madhya Pradesh and Bihar. The SLACC-Cropin project has positively impacted more than 8,000 farmers in the districts it was adopted in.

DeHaat is another full-stack agriculture platform provider, whose solutions span across the supply chain, from sourcing of farm requirements and soil testing to tech based advisory and selling of produce.

Unnati Agri, a fintech-driven agriculture service platform, raised US$8 million in a Series A round during FY22. It provides financial management services to farmers to solve their working capital requirements and supports them throughout their farming cycle. Registered farmers can buy seeds, pesticides, fertilisers and other products from sellers listed on Unnati. On the other hand, they can also sell their produce directly to food processors and agri-businesses on the same platform.

Farm-to-fork. Aibono specialises in aggregation and just-in-time supply of fresh fruits and vegetables. They specialise in farm-to-fork or 'kisan-to-kitchen' supply of agricultural produce directly from farms to consumers, with complete traceability.

Ninjacart also focuses on the supply chain. They connect producers of food directly with retailers, restaurants, and service providers using in-house applications that drive end-to-end operations. They currently operate in seven cities, and their supply chain is equipped to move 1,400 tonnes of perishables from farms to businesses, every day, in less than 12 hours.

Ecozen is another farm-to-fork venture founded by an IIT Kharagpur alumni, which aims to optimise the way perishables are handled across the value chain, with clean and innovative technology. ReshaMandi is also an end-to-end platform, but focuses on the natural fibres industry—it is farm-to-fashion, rather than farm-to-fork!

AgroStar, Otipy, Poshn, Arya.ag, Apna Godam, Agrowave, Bijak, Crofarm, Clover Ventures, Ergos, Farm2Fam, and WayCool are other food supply chain startups to watch.

Traceability. TraceX builds blockchain powered traceability solutions that can be used to build transparency and trust into the agricultural supply chain. It can be used for a variety of purposes, from seed traceability to managing contract farmers.

Their TraceCarbon is a blockchain-powered carbon management platform, which helps companies to decarbonise Scope 3 emissions, in their journey towards being carbon neutral. Scope 3 emissions are those emissions that are not actually produced by the directly-owned assets or activities of the company, but those produced up or down the value chain, but for which the company is responsible. For example, emissions caused by contract farmers.

Solutions from the younger generation

It is interesting to see students developing solutions to solve problems faced by farmers, often their own kith and kin, in remote rural areas. This kind of connect to their roots gives us hope that the next generation will help revive the agricultural sector using the right technologies.

Kishan Know is one such indigenous AI solution developed by three young students at the Vellore

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Institute of Technology, Chennai. They were declared global winners of the first edition of the Intel AI Global Impact Festival. One of these students, Rishikesh Amit Nayak, hails from a village in Orissa called Khatuapada, which lost 54% of its harvest in 2017 due to a microbial attack, and many farmers in the village were pushed into heavy debt.

Microbial and pest attacks account for 80% of crop failure in India, with the monetary value of crops lost exceeding US$500 billion. So, together with two of his friends Nayak set about finding a solution for this problem. Their solution uses thermal imagery, powered by IoT, Intel processors, and sensors, to detect microbial and pest attacks, and estimate irrigation in the fields.

Their device functions on real-time data to detect bacteria, fungi, and viruses in crops, and uses IoT to arrive at a micro-level solution," says Khurana. "Currently, the prototype version is available for ₹1,500. These students are now working with agricultural departments to validate and implement this project so that it can serve its larger societal purpose."

A 14-year-old from the Lalitpur district of Uttar Pradesh, Nandani Kushwaha, recently secured a place amongst the top 20 young innovators of the country for her AI based innovative project—*Mitti ko Jaano, Fasal Pehchano*. "This soil analysis and crop recommendation technology is a smart data based AI tool that identifies the most suitable crop that can be planted by analysing the various nutritional components present in the soil. This model can be deployed as a physical soil-detecting tool that will help farmers understand their soil accurately and make informed decisions," explains Khurana.

Likewise, Isha Biswas, a student from a Kendriya Vidyalaya school in Arunachal Pradesh, has developed an AI technology for farmers to identify crops that can be best harvested at a given time. Her solution also suggests suitable crops that can be planted in a particular type of soil after assessing several ecological and environmental factors.

'Weed and Crop Detection System' developed by Vaibhav Dewangan and Dhiraj Kumar Yadaw from Chhattisgarh is another AI powered technology, which helps identify different types of weeds in farms and aid in their removal.

We also found a couple of interesting farming bots developed by young students mentored by Dimple Verma of WhizRobo, finding a mention in the India Book of Records. Viraj Gupta, an 11-year-old boy from Ludhiana, has developed Krishi-Bot, a robot that can help with multiple tasks on a farm, from ploughing and planting to irrigation and harvesting. It can also check the soil to decide whether it needs watering or not. The robot can be controlled remotely by the farmer, and allows remote monitoring of weather. The prototype was built at a total cost of just ₹6,000.

The agricultural drone developed by Aryaman Verma can help with irrigation, spraying, and surveillance of the farms with a battery backup of 15-20 minutes. It is trained to return to the base once the battery is discharged. Equipped with cameras and sensors, the drone can also gather data on crop health, yield, and other important metrics.

Another young techie, Yashvardhan Singhvi, has made an autonomous crop-scouting and weeding robot. It is equipped with navigation systems and precision tools to carefully move around fields and remove weeds without damaging crops.

Reaching the grassroots—infra, trust, and affordability

Despite the availability of quality agri-tech solutions, why is the uptake of tech still low at the grassroots level, and how can this be overcome?

"The current situation shows that early adoption of emerging technology has only been done by larger farmers with sufficient funds and scope to afford and implement the tools for precision and smart farming. However, there are pilots and lighthouse instances where groups of small and marginal farmers at the village or district level have come together to practice smart farming, which can be scaled with state interventions," says Khurana of Intel.

Jalan suggests that these challenges can be addressed if agri-tech companies adopt a B2B or B2G model. "Government and private sector companies work with farmers and provide them with technical support, and finance to run the farm effectively. This is exactly what we do at Cropin. Farmers do not have to pay for our solutions as we deploy them in partnerships with our B2B and B2G customers, breaking the financial barrier in tech adoption. This not only solves the problem of affordability, but also ensures impact at scale, which is difficult to achieve working with individual farms holdings," he says, adding that, "Meaningful and enduring transformation of agriculture is not possible unless smallholder farmers at the grassroots level are trained and enabled to adopt smarter, more efficient, and sustainable ways of farming. Digitisation and intuitive, inexpensive, and easily accessible technology can go a long way in making this happen."

According to Khurana, we also need creative public-private partnership initiatives in India to accelerate the adoption of technology in agriculture. She cites the example of Agristack, which is based on the India Digital Ecosystem of Agriculture (IDEA) framework. "It provides data

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and relevant information to farmers as well as private sector organisations working in the agriculture ecosystem to create a more informed and precise demand-supply chain. IDEA focuses on the creation of digital readiness, open data sources, OneAPI, and innovation to reduce the cost of smart farming," she explains.

In December 2022, the Department of Agriculture and Farmers Welfare announced that it has commenced efforts to create Agristack, which is a collection of technologies and digital databases focusing on India's farmers and the agricultural sector. The platform will serve as a farmer interface for 'smart and well-organised agriculture' and help tackle issues such as poor access to credit and wastage in the agricultural supply chain. The department entered into memorandums of understanding (MoUs) with leading technology companies, including Microsoft India, Amazon Web Services India, ITC, Cisco, and Ninjacart, to develop proof-of-concept for different focus areas or layers of the platform.

Jalan remarks that overcoming infrastructure challenges is crucial for our country to make it more Atma Nirbhar. "Adequate infrastructure improves farm productivity and reduces costs. There are several efforts already taken by our government to improve it. For example, the plan to set up a digital public infrastructure for agriculture is a welcome step, which ensures enhanced connectivity, and streamlines the supply chain, which in turn improves production. Another recent announcement was to set up 100 labs in engineering institutions, for developing applications using 5G services, which will further accelerate solutions for connectivity in various sectors including agriculture," he says.

In some cases, even when there are no financial constraints, farmers are still unable to benefit from a solution because of illiteracy and language barriers. Being able to converse with a tech platform in their native language might enable more farmers to access technology. At the World Economic Forum in January this year, Microsoft CEO Satya Nadella spoke about how an Indian farmer was able to access online government services with the help of ChatGPT.

Experts

Rajesh Jalan, Chief Technology Officer, Cropin

Shweta Khurana, Senior Director - APJ, Government Partnerships & Initiatives, Global Government Affairs, Intel

In order to demonstrate the benefits of using drones to Indian farmers, drone maker Garuda Aerospace recently signed an MoU with Tata Chemicals' subsidiary Rallis India Limited. Rallis will supply pesticides and crop nutrients to Garuda Aerospace, which will use drones to spray these on fields.

Khurana suggests that, "The mantras for agri-tech startups should be around low cost and high efficiency, with absolute ease of use. To align better with the Indian farmers' mindsets and constraints, the startups should also build a close-looped feedback mechanism where they can ensure that their products are viable, implementable, and affordable for small and marginal farmers."

The way ahead

According to the India Brand Equity Foundation, India ranks third in terms of agri-tech funding and number of agri-tech startups. By 2025, Indian agri-tech companies are likely to witness investments worth US$30-35 billion.

The Union Budget for 2023-24 aims to give a big boost to Indian agri-tech startups. Finance Minister Nirmala Sitharaman announced that a new 'Agriculture Accelerator Fund' would be set up to encourage agri startups founded by young entrepreneurs in rural areas. "The Fund will aim at bringing innovative and affordable solutions for challenges faced by farmers. It will also bring in modern technologies to transform agricultural practices, increase productivity and profitability," she said in her Budget Speech.

She also announced plans to build a digital public infrastructure for agriculture, which will, in her words, "… enable inclusive, farmer-centric solutions through relevant information services for crop planning and health, improved access to farm inputs, credit, and insurance, help for crop estimation, market intelligence, and support for growth of agri-tech industry and startups."

"I foresee that the farming community in India will drive the mass adoption of technology in the coming years, similar to the fintech revolution in the last decade. The ecosystem is working together to democratise agriculture and help the community with solutions addressing their day-to-day requirements, such as healthy crops, increased yield, and managing any risks proactively. The future of smart farming looks bright and promising in India," Jalan signs off on a positive note. EFY

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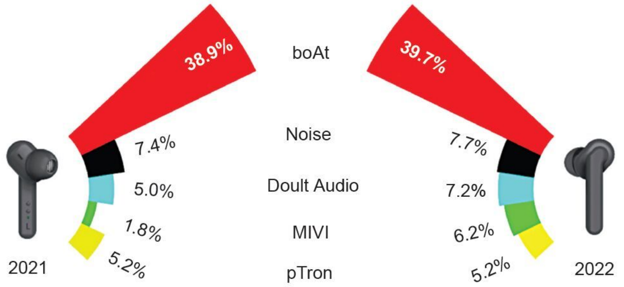
2022 Proves Good for Indian TWS Market Shipments

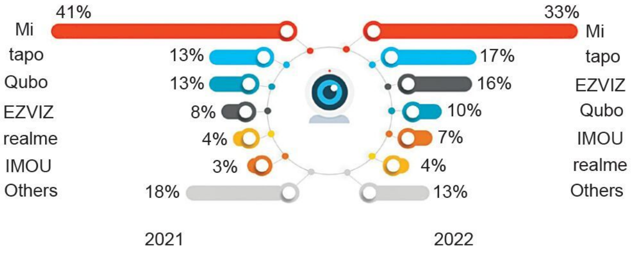
As per the latest report by Counterpoint's IoT service, India's TWS market shipments registered 85% YoY growth in 2022. Notably, domestic manufacturing is on the rise as it grabbed about 30% of shipment share in 2022, compared to just 2% in 2021. Counterpoint counts rise in local manufacturing, timely sales events, frequent affordable offerings, and entry of new players as the major driving factors of increased shipments. Unprecedentedly, Indian brands held all the top five spots in the India TWS market. This caused Indian brands to reach their highest-ever share of 80% in 2022. The report added that the average selling price dropped by 20% YoY last year.



(Source: Counterpoint Research)

2022: India Smart Home Security Camera Shipments Saw 44% Growth; Xiaomi Tops

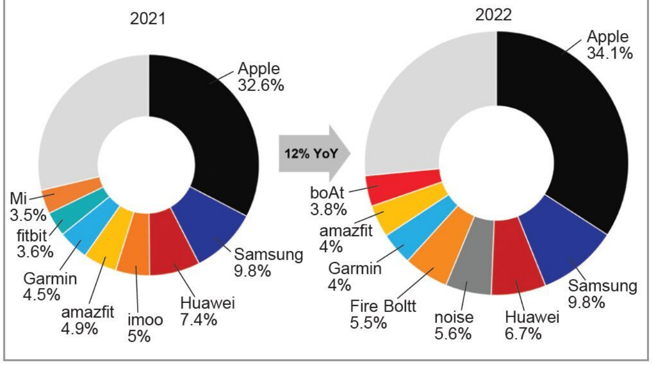
As per a recent report by Counterpoint, India's smart home security camera market shipments grew 44% YoY last year. Notably, shipments in the price range of ₹1,500-2,500 took away 64% share—the highest in 2022. The report mentioned that while Xiaomi stood first in terms of shipments with a 33% share, Tapo witnessed a whooping growth and stood next to Xiaomi in 2022 with a 17% share. However, said the report, the market slowed down in the last quarter of 2022 owing to seasonality and weaker demand, and didn't grow significantly.



(Source: Counterpoint Research)

Global Smartwatch Shipments Witness Decent Growth in 2022

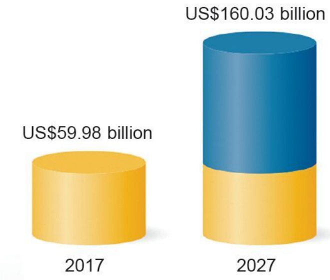
According to a recently published report by Counterpoint, the global smartwatch market shipments grew 12% year-on-year (YoY) in 2022 due to the strong YoY growth seen in the first three quarters of the year. But, the report added, the shipments dropped 2% YoY in Q4 2022 amid inflationary pressures and slow domestic growth. It noted that this was the market's first negative growth in eight quarters since the Covid-19 spread in 2020. Indian brands Noise and Fire Boltt made it to the list of global top 5 sellers. Interestingly, this year witnessed price polarisation in demand. The report suggested that the shipments in the mid-price range dropped while those in the >$400 and ≤$100 segments grew 129% and 34%, respectively, compared to 2021.



(Source: Counterpoint Research)

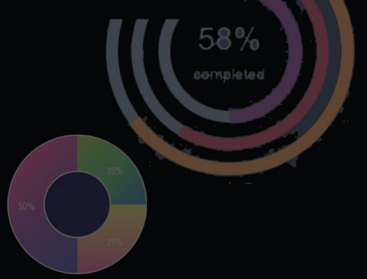
Indian Consumer Electronics Market to Reach $160 Billion by 2027

The Indian consumer electronics and appliances market was valued at $78.95 billion in 2021, which was taken as the base year. It is expected to grow at a compound annual growth rate (CAGR) of 12.78% during the forecast period of 2023-2027, to reach $160.03 billion by 2027. Based on type, the market is divided into audio and visual electronics, home appliances, kitchen appliances, and personal care devices. The audio & visual electronics segment dominated the market in 2021 and held 85.02% of the total market share. Market players are trying to reach remote locations by investing in developing an efficient supply chain and inventory and adopting e-commerce websites to sell their products. Rising incomes of middle-class families, and companies working on the development of high-performing and easy-to-use devices to meet the growing consumer requirements, are expected to fuel the demand for consumer electronics in the forecast period.



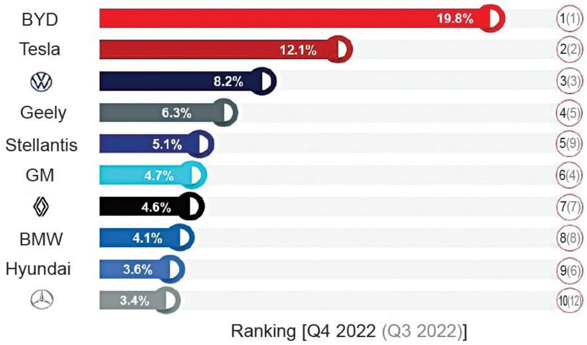
(Source: www.researchandmarkets.com)

At-a-glance view of key industry trends that can shape the future of your business…



Global EV Sales Touch 10 Mn Milestone in 2022

Going by the latest Counterpoint report, global passenger electric vehicle (EV) sales in Q4 2022 witnessed a major year-on-year hike of 53%, bringing the 2022 total to over 10.2 million units. Counterpoint's global passenger electric vehicle model sales tracker for Q4 2022 found out that during this quarter, battery EVs (BEVs) accounted for almost 72% of all EV sales, while plug-in hybrid EVs (PHEVs) accounted for the remaining 28%. While China, Germany, and the US emerged as the top three EV markets, it is interesting to note that the top 10 EV automotive groups, which hold over 39 passenger car brands, contributed to almost 72% of all EV sales in Q4 2022. Tesla's Model Y stood firm as the globally best-selling model in electric vehicles, followed by BYD's Song in Q4 2022.

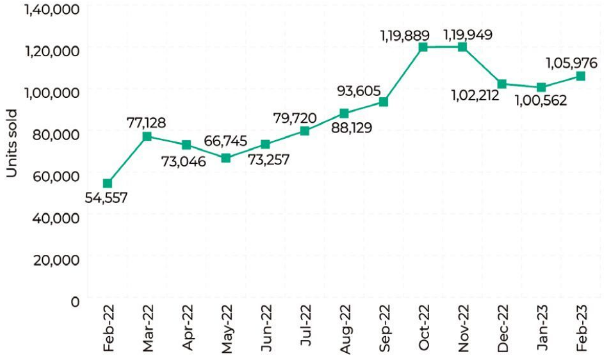


Ranking [Q4 2022 (Q3 2022)]

(Source: Counterpoint Research)

February 2023: EV Sales in India

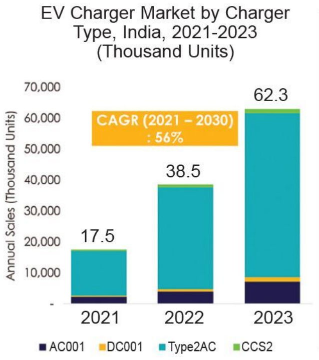
As per the latest report by JMK Research, the sale of electric vehicles (EVs) in India increased by over 5% month-on-month in the month of February. Moreover, on a year-on-year basis, the EV sales trend suggested almost a doubling of the EVs sold in Feb 2023, from that of Feb 2022. While 54,557 vehicles were sold in the market in Feb last year, this February witnessed the sale of 105,976 e-vehicles in India, an increase of a whopping 94%, indicating a significant market growth for electric vehicles. The Vahan Dashboard of JMK revealed that electric two-wheelers and passenger-type electric three-wheelers were significant factors behind EV registrations this month. Notably, these two categories constituted over 90% of total registrations in Feb'23.

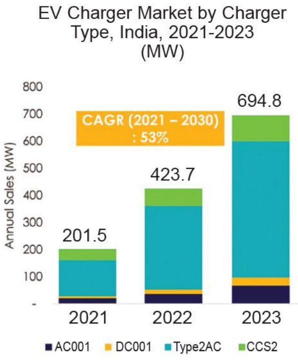


(Source: JMK Research)

Indian EV Charger Market Set to Grow at 56% CAGR

As per a recent report by Customised Energy Solutions, by 2023, India's EV charger market is expected to witness a CAGR of over 50% during the 2021-2030 time period. It is hoped that deployments will be done across selected expressways and highways whose tendering process was completed in 2022. Still, predominant type2AC would be deployed as it is majorly used by EV OEMs for supplying with the passenger e-4Ws. The next in line is AC001, which is still far back in the race but is expected to penetrate gradually.

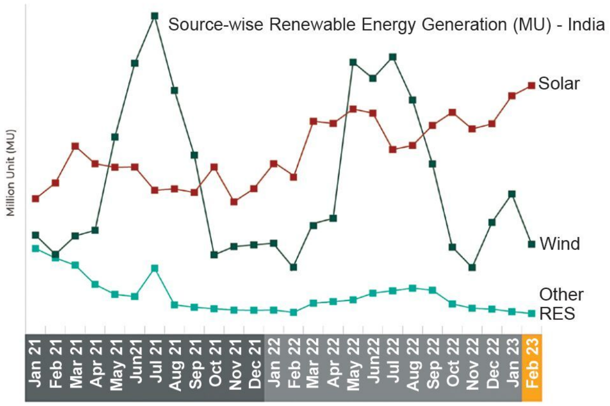

EV Charger Market by Charger Type, India, 2021-2023 (Thousand Units)


EV Charger Market by Charger Type, India, 2021-2023 (MW)

(Source: https://indiaesa.info)

February 2023: RE Installations in India

As per the latest report by JMK Research, the total energy generated from renewable sources in February 2023 dropped 10.4% lower than the RE generation in January 2023. On the upside, solar generation increased by 4.26% month-on-month. But at the same time, wind generation decreased by 35.82%, causing a major decline in the overall trend. Reportedly, a sum of around $499 million was invested in the Indian renewable energy (RE) sector last month. As per the research, 24 new RE tenders with a cumulative capacity of 8,508MW were issued in the month of February. Gujarat emerged as the No. 1 state to add the maximum RE capacity, both solar and wind, in January 2023.



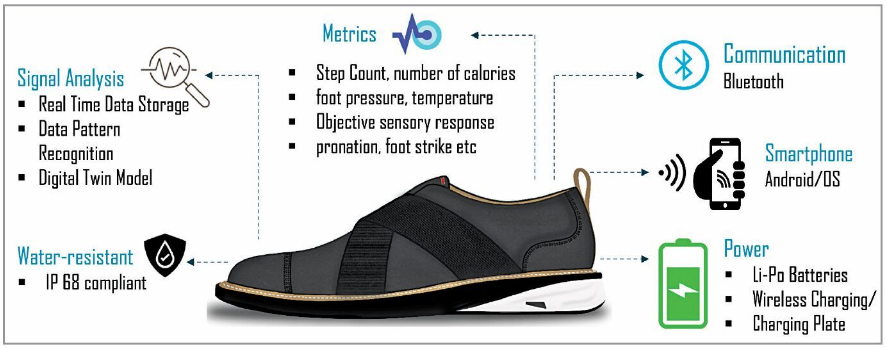
(Source: JMK Research)

STARTUPS
& INNOVATORS

1 Deciphering Brain With Semi-VR Cognitive Games
2 D'Zine-ing A Greener World With Electric Mobility
3 A Semi-Bionic Hand That Helps The Users To Touch And Feel

1 DECIPHERING BRAIN WITH SEMI-VR COGNITIVE GAMES

Your brain controls your body—with this basic concept, a Bengaluru based startup called Xeuron.ai is developing active intelligent footwear and virtual reality cognitive games as a solution for urban burnout and disease management


Metrics
Step Count, number of calories
foot pressure, temperature
Objective sensory response
pronation, foot strike etc
Signal Analysis
Real Time Data Storage
Data Pattern Recognition
Digital Twin Model
Communication
Bluetooth
Smartphone
Android/OS
Water-resistant
IP 68 compliant
Power
Li-Po Batteries
Wireless Charging/
Charging Plate

A lady got diabetes in her mid-30s and by the time she reached her early 40s, it started affecting her retina, teeth, and slowly each part of her body. This prompted her bioengineer son, Siddharth Nair, to innovate a non-invasive neural modulation system, which helped her walk again.

From here started a journey to develop intelligent connected systems to monitor and predict the risk of neurodegeneration. Siddharth established Xeuron.ai in mid-2019 but started working on it seriously only after the pandemic had hit.

The founder says, "The initial idea was to just develop smart footwear and insoles consisting of embedded sensors and then do a lot of things. But then, with all the emerging technology and the need for adaptability to the user, it all came to a point of business sustainability. Hence, we migrated to semi-immersive virtual reality (semi-VR) to start with, and the smart footwear that we are developing would help build the whole ecosystem."

Xeuron.ai works towards a hybrid approach for keeping the mind of a modern-age person young. It does so with the help of semi-VR games, where the body remains active while playing. Instead of just pressing the joystick, you actually run, jump, and lift yourself everywhere. Now, if you're wearing smart footwear, it will look into all your bodily parameters.

Siddharth remarks, "While they are immersed in the game, we are able to track their body and mind such that we could help in preventing diseases. If they already have a disease, we could monitor how the disease is progressing. If they're undergoing any treatment, we could look into the efficacy of the treatment. In future, we are hoping that we could also predict the disease."

In 2020, the startup began developing smart footwear that would sense motions, pressure, temperature, and even the neuromuscular response of the person. "We got a couple of grants from DST-NIDHI's PRomoting and Accelerating Young and ASpiring technology entrepreneurs (PRAYAS), IISc MSME, COE Clinic, and some prize money here and there," informs Siddharth.

But when the pandemic initiated major disruptions in the semiconductors industry, Xeuron.ai decided to bring computer vision into the picture and build an AI around it. "I'm glad that we did that because, if you see, the scalability of a business is much faster when there's less hardware to start with. And, of course, we can keep adding hardware later. So, we took that approach and hence we reached our MVP after a couple of pivots," says the founder.

According to him, deciphering the brain and cognition is their biggest USP as no one is significantly working in this direction. "There

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are so many players in diabetic and mental health disease management, like Fitterfly, CogniFit, Lumosity, etc, but there is no physical involvement. Even if they know about the working of the brain, they don't know how the body is responding to the brain. That's where we make a difference as we are able to track the brain function with how your body is responding to your brain signals, and the best part is that we're doing it without using any external headset or devices."

Xeuron.ai tracks 72 cognitive parameters with the help of the users' webcam. "We only show them six of them at a time and help them improve upon those before jumping on to the next six parameters," Siddharth points out.

The Xeuron.ai team (Siddharth on the right)

The digital therapeutics solution initially focusing on wellness is called ReLive, and it was launched in February this year. Siddharth informs, "Currently, we have just one game. Slowly, more games will be added on ReLive, which will look into wellness management."

The startup provides access to its platform for ₹999 per year per user, while AI-managed digital therapeutics on the same platform cost more.

When asked why the name of his company starts with an X, Siddharth says, "That's the unknown that we're here to find." The 11-member-strong startup is working on smart insoles and footwear while also developing ReLive to ultimately make the human brain, body, and blood work better together.

—Vaishali Yadav

2

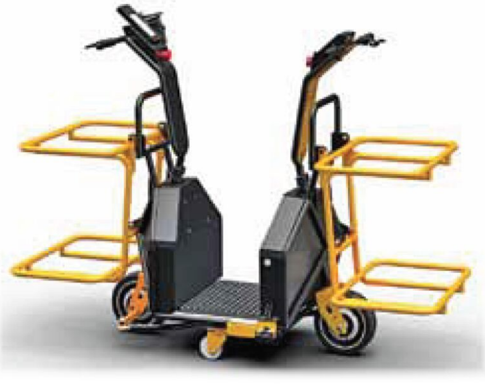
D'ZINE-ING A GREENER WORLD WITH ELECTRIC MOBILITY

Bengaluru based startup Greendzine Technologies is decarbonising mobility through its light electric mobility solutions for the warehouse-to-home market. The company has over 30 intellectual properties (IPs) but what catches an innovator's eye is its infinity charger module for electric vehicles

Aggressive expansion of the e-commerce sector and a sustained rise in demand led by accelerating manufacturing investments have resulted in the growth of new and emerging warehousing technologies to ease material handling and management in warehouses.

Bengaluru based Greendzine Technologies has joined the movement and intends to replace the mundane work of manual movement and material handling within the warehouse with an autonomous solution to get better repeatability, accuracy, and reliability. With more than 30 IPs related to vehicle design, architecture, electric powertrain, charger technology, and battery cooling system to its credit, the company aims to ease warehouse mobility through its smart picking solution MOPTro.

MOPTro eliminates the tedious manual picking process for operators, ensuring accurate picking and put-away. The electric vehicle comes with an application software on a mobile device attached to the MOPTro, which shows the fastest aisle route to picking a product, thus enabling greater throughput.


MOPTro Snail

The electric vehicle is designed to manoeuvre through short narrow aisles. The EV can be controlled for bidirectional movement, which increases the productivity in picking, put-away, and transportation at a warehouse.

Founded in 2015, Greendzine has a range of electric vehicles to support different segments—Quark EV for personal commute, MOPTro EV for warehousing applications, and Irrway EV for fun and leisure mobility in amusement parks and go-kart tracks. Currently, the startup has sold 350 units of the product along with the charger. Overall it has sold around 1,000 vehicles across all sectors.

The company says that its MOPTros can be deployed in a minimum warehouse size of about 4,645 square metres

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Bengaluru: Survey No 27/4 A3,
JR Tech Park, Yarandahalli,
Bommasandra Indl Area, Ph 4,
Bengaluru, Karnataka-560099

Chennai: Plot No. B27, Phase
II, Zone B, MEPZ-SEZ,
Tambaram, Chennai –
600045

R & D Centers : Winnenden, Germany | Gurgaon, India | Chennai, India

www.syrmasgs.com | info@syrmasgs.com

Greendzine Technologies team

Greendzine's Infinity charger charging Quark EV

(50,000 square feet) to achieve a 30% increase in productivity. The products are direct plug and play solutions. The company has distributors all over India and also sells directly to its customers.

Despite having different EV designs for each segment, all of the green mobility solutions come with a single charging module that can be used with any other electric vehicle, be it a two-wheeler or a three-wheeler. The charging modules can be connected in series and parallel to trigger the charging mechanism to charge each other.

"In power electronics, you cannot connect two power-generating converters in series, because you would get into load balancing issues. We also faced that problem, but we were able to solve it through multiple iterations, and we ultimately used a special switching mechanism called GaN FET. We were able to switch GaN FET switches at a frequency of 1MHz, increasing the power density of the charger," explains co-founder Karthikeyan Sundaram.

Sundaram says that the team overcame the challenge to prevent the switch from bursting or catching fire at that frequency. The company has added this technology along with the cooling system for the charger to its list of IPs. While using immersive cooling technology, the power electronics board is immersed in a water-like solution, which is developed in-house. The whole charging module is compact.

"Our charger is half the size of the ones available in the market but can deliver the same capacity of power as the ones available in the market. The same charger can be used to charge an electric cycle. Two charging modules can be used to charge a bike. Three can be used to charge autos and cars. More than four or five can be used to charge an electric bus," Sundaram informs.

Incubated under IIIT Bengaluru Innovation Centre, the startup has received an undisclosed amount of funding from Karnataka IT Venture Capital (KITVEN) Fund. The company designs the components and places an order with its manufacturing partners for the same. Once the components are received, it assembles the parts and tests the EVs at the Bengaluru facility.

Greendzine is currently looking for powertrain and ECU components vendors and partners to expand its business. The company has managed to veer its way through inflation and supply chain constraints.

Co-founder Anjan Kumar N. says that they overcame these challenges by resizing their order size for production and re-negotiating vendor contracts. The company is currently running pilots to connect all its EV products onto one single software platform. To ensure that the economy yields more productivity per person, they would need to keep automating their lower-value-addition jobs, so that people can keep moving towards higher-value-addition jobs and solutions like MOPTro.

—Yashasvini Razdan

3 A SEMI-BIONIC HAND THAT HELPS THE USERS TO TOUCH AND FEEL

A bionic arm is not the last resort but a new beginning, a second chance at life. Robo Bionics is aiding people having arms disability through their bionic arm, Grippy. The company hopes to make bionic arms affordable for all

While doing M.Tech at IIT Patna, a close friend of Llewellyn D'sa had arm disability since birth. The problems faced by his friend inspired him to do something for people having similar disabilities. On learning about bionic arms, he realised that most prosthetics available in the

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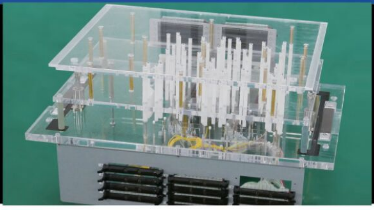

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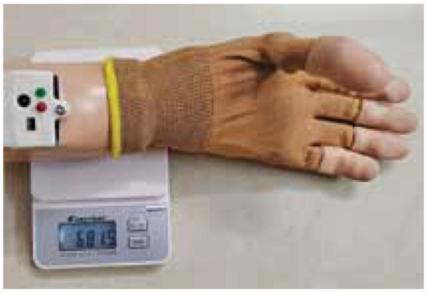
Anil Nair, CTO (left), Llewellyn D'sa, CEO, and Priyanka D'sa, COO

GRIPPY
by
Robo Bionics
#aHandForIndependence

Person fitted with Grippy reading a newspaper



Grippy on a weighing scale

Indian market were either very expensive or were of low quality. Moreover, the repair of products was either not possible or was very expensive.

So, in order to help people with a missing arm, Llewellyn decided to take up research and development of indigenous bionic arms as his M. Tech project. He and his friends, who helped him with the project, started Robo Bionics. From the first prototype to the final product, the journey took them around three and a half years and almost ten iterations to reach where they are today.

Robo Bionics tested their bionic arms on ten disabled people who were chosen for the trials. Since then, the company has fitted bionic arms to more than 50 people across India.

The current bionic arm from Robo Bionics is called Grippy. It is a lightweight, affordable, battery-powered prosthetic arm, which is suitable for anyone over the age of 15 years with below-elbow amputation.

Unlike most bionic arms available in the market, which can't cater to people with different muscle strengths, Grippy can be programmed based on the user's muscle strength. This gives them accurate control over the device.

Grippy can enable the user to sense objects. Moreover, it can differentiate between a soft and a hard object and offers an automatically adjusted grip control, which enables the user to hold an object without damaging it with excessive force. The ability to program Grippy makes it very easy to use; most people are able to control it on the very first day.

Imported bionics arms made of titanium weigh around 600 grams and cost around a million rupees. Grippy having a similar weight costs one-fourth of that, making smart prosthetics arms accessible to a larger population in India.

Robo Bionics employs 3D printing technology to print the entire shell of the bionic arm. They use a proprietary thermoplastic material, which is lightweight but has strength comparable to the human arms. Grippy can sustain temperatures up to 125°C and can lift up to 5kg in a hook grip, which is required for holding a bag or a briefcase.

Llewellyn D'sa says, "Currently, the hand fitting process takes two to three weeks. With the upgradation of technology and utilisation of additive manufacturing, we could actually see the process complete in a matter of may be two to three days."

Being a bionic arm, Grippy employs various sensors and actuators to sense and hold objects. It contains a microcontroller peripheral unit, current sensing ICs, the inertial measurement unit (IMU), etc. Besides, there is an indicator system, operational amplifiers, isolation amplifiers, and the display system. As each electronic subsystem of the arm needs its own power source, power regulators and batteries to power the whole system are essential for it.

Llewellyn believes that, in future, the bionic arm will become lighter and will have better battery efficiency, better power delivery, and IoT connectivity. Integration of IoT will give proper feedback to the patient as well as the caregiver or a doctor. Apart from that there will be an integration of artificial intelligence, which will help the users to have proper coordination and application of force based on the object.

He hopes that insurance companies would step up their game and include rehabilitation technology as a point of care system. He also looks up to the government to launch new schemes to help people with disabilities. With such support, the company hopes to succeed in empowering individuals suffering from limb loss to regain their independence and achieve their full potential. EFY

—*Sharad Bhowmick*

INDUSTRY NEWS

INDUSTRY UPDATES

After Ladakh, Karnataka awaits decision on lithium reserves in Mandya

After the Indian government's recent declaration of commercial exploration of lithium reserves in Ladakh, Karnataka is waiting for directives from the Atomic Minerals Directorate for Exploration and Research (AMD)—a constituent unit of the Department of Atomic Energy—to begin exploring the lithium reserves in Mandya district. The department had conducted preliminary surveys on the surface and limited subsurface and found a presence of lithium resources of 1,600 tonnes (inferred category) in the pegmatites of Marlagalla-Allapatna area, Mandya district, Karnataka. The information was publicly revealed in February 2021, but no action has been taken yet.

Representational image

PEOPLE (on the move)

Tessy Thomas wins The ACCS Foundation Award for 2022

The Advanced Computing and Communications Society (ACCS) has announced the name of Dr (Ms) Tessy Thomas, distinguished scientist and Director General (Aeronautical Systems) of the Indian Defence Research and Development Organisation (DRDO), as the winner of the prestigious ACCS Foundation Award for the year 2022. The Award recognises her outstanding contribution to the Guidance, Control, Inertial Navigation, Trajectory Simulation and Mission Design for long-range ballistic missiles that shaped India's strategic defence capability.

Atlassian appoints Anutthara Bharadwaj as the new President

Atlassian Corporation, a leading provider of team collaboration and productivity software, announced the promotion of Anutthara Bharadwaj to the post of President. In her new role, Bharadwaj will lead and support the newly unified 'Markets and Transformations' organisation, with a focus on accelerating product innovation and driving enterprise adoption. She joined Atlassian in 2014 as the Head of Product for Jira and held many roles during her tenure. She is a member of OutSystem's board of directors and serves as the Director of Atlassian Foundation.

Tech Mahindra welcomes Mohit Joshi as new MD and CEO

A leader in re-engineering services and digital consulting, Tech Mahindra said that Mohit will join soon to allow for sufficient transition time and will take over the position when C.P. Gurnani retires later this year. The company noted that Mohit has over two decades of experience in the enterprise technology software and consulting space and has worked with the largest corporations in the world in driving digital transformation and building thriving businesses. Previously, Mohit has been a non-executive Director at Aviva Plc since 2020 and is a member of its risk & governance and nomination committees. Moreover, he has been the President of Infosys.

Green Circuits welcomes Mark Evans as COO

US based leading electronics manufacturing services (EMS) provider recently announced the appointment of Mark Evans as Chief Operating Officer (COO). With over 34 years of industry experience in overseeing production, quality, engineering, materials, HR and document control teams, the company said that he brings energy, enthusiasm and experience to Green Circuits' operations and supply chain. It further noted that in a previous role, it took him just two years to take the revenue rate from $17 million to $100 million.

INTERNATIONAL news

Infineon acquires GaN Systems to boost GaN portfolio

German semiconductor company Infineon Technologies AG and Canadian gallium nitride (GaN) power semiconductors provider GaN Systems Inc. have signed a definitive agreement under which Infineon will acquire GaN Systems for $830 million. In an official note, the acquirer pointed out that GaN, as a wide bandgap material, offers customer value through higher power density, higher efficiency, and size reductions—especially at higher switching frequencies—enabling energy savings and smaller form factors. With the aim to reinforce its global leadership in power systems, the German chipmaker will utilise the existing liquidity to fund the planned acquisition.

Digi-Key adds over 550 new suppliers and 75,000 SKUs in 2022

Leading electronic components distributor Digi-Key Electronics recently announced that they expanded its portfolio in 2022 by adding over 550 new suppliers across their core business Digi-Key Marketplace and fulfilled by Digi-Key program. They also added over 75,000 new stock keeping units (SKUs) to their core business unit last year. The official release noted AirBorn, Endress+Hauser, EPC Space, Isabellenhutte, and Schneider Electric as some of the key suppliers added to the Digi-Key portfolio in 2022. It further said that long-term suppliers, like Amphenol, continue to expand their offerings by adding new products from various divisions.

Anritsu partners with Artiza for Open RAN test solution

In a recent test and measurement industry update, Anritsu Corporation and Artiza Networks agreed to collaborate on an Open RAN (Radio Access Network) test solution. As per the deal, Anritsu's wireless test solutions for PHY-layer measurements, such as signal analysers and signal generators, will be combined with Artiza Networks' base station/network load test solutions for upper layers. The partners claim that it will offer high-level, wide-ranging solutions to issues faced by Open RAN.

The Open RAN concept uses open specifications for network interfaces to facilitate expanded services through multi-vendor sourcing, cost-reducing, and rollout of AI applications, as well as to create a new ecosystem as a long-term driver generating business opportunities.

indie Semiconductor acquires Germany based Silicon Radar

Automotive chip designer and maker indie Semiconductor recently acquired Germany based Silicon Radar. The companies did not disclose any financial information regarding the deal. The acquisition supports indie's radar research and development staffing plan. The company has made heavy investments in its research and development due to the massive opportunity in the automotive semiconductor space that is forecast to surge from $37 billion in the total addressable market in 2022 to $62 billion by 2027. Silicon Radar has previously worked closely with indie Semiconductor in co-developing radar solutions for emerging radar applications, including 120GHz and 140GHz frequencies.

Microchip to boost SiC and Si production capacity amid growing demand

Leading provider of embedded control solutions Microchip Technology is set to expand its silicon carbide (SiC) and silicon (Si) production capacity at its Colorado Springs, Colo. manufacturing facility over the next several years. Overall, the company plans to invest $880 million in the project aimed at amplifying its production capacity, which will enable Microchip to respond to growing semiconductor demand across industries. It will expand its Colorado Springs plant to produce more silicon and silicon carbide.

Bentley Systems acquires electrical engineering software developer EasyPower

Leading infrastructure engineering software company Bentley Systems, Inc. recently announced that it has acquired Easy-

India and Lithuania to collaborate in STEM and other areas, including high-tech startups

Recently, a high-level delegation from the Republic of Lithuania led by its Vice-Minister of the Economy and Innovation, Karolis Žemaitis, called on Union Minister for Science and Technology, Dr Jitendra Singh, in North Block in New Delhi and discussed the ways and means to revive a long-pending deal. Through MEA, the Department of Science & Technology (DST) has been negotiating a science and technology agreement with the government of Lithuania since 2010. Lithuania assured that it has robust knowhow and capacities in life sciences, biotechnology, and other STEM areas and is keen to cooperate on high-tech startups.

Smart energy meter and EV charger tech transferred by C-DAC to industry partners

At the C-DAC, Thiruvananthapuram, the Secretary to the Ministry of Electronics & Information Technology (MeitY), Alkesh Kumar Sharma, recently witnessed the transfer of indigenous technology on smart energy meters and an electric vehicle charger to industry partners. The official statement noted that the smart energy meter developed by C-DAC is based on Indian standards and suitable for advanced metering infrastructure. Further, it is compatible with smart grid communication technologies and supports distributed generations. The AC charger has been developed as per Bharat EV AC charger (BEVC-AC001) specifications and AIS-138 standards.

India's first indigenous signalling system launched by Delhi Metro

In a major development on India's rail based mass transit front, the Delhi Metro recently launched the country's first-ever indigenously developed train control and supervision system. The i-ATS (Indigenous-Automatic Train Supervision) has been jointly developed by Navratna Defence PSU Bharat Electronics Limited (BEL) and Delhi Metro Rail Corporation (DMRC), for operations on its first corridor, Red Line. It will be deployed for operations on Delhi Metro's other operational corridors as well. The ATS is a computer based system to manage train operations. With this, India has become the sixth country to join the elite list of a few nations

Power, a leading developer of design and analysis software tools, including arc flash solutions, for electrical engineering professionals. Its acquisition of EasyPower, said Bentley, to extend integrated and iterative power systems design and analysis for infrastructure digital twins of every type, broadens its comprehensiveness in infrastructure engineering. The acquisition initially adds 45 expert colleagues in North America. Bentley said that EasyPower's interface empowers users to digitise their electrical systems and enables the design, analysis, and optimisation of complex electrical power distribution systems.

Fusion Worldwide opens new global offices in EMEA and APAC regions

Leading open market sourcing distributor for electronic components Fusion Worldwide recently announced expansions to offices in Germany, Japan, and the opening of new offices in Taiwan and New Hampshire. The company believes that the investments in Asia-Pacific (APAC) and Europe, the Middle East, and Africa (EMEA) will improve service and experience in high-density customer locations supporting industries, including automotive, telecommunications, industrial, aerospace, and defence. In an official statement, Fusion pointed out that chip shortages, manufacturing disruptions, and increased demand have changed the supply chain operations over the last few years. It plans to add new technical capabilities to its services and test facilities, with an increase in warehouse personnel and IT roles.

Empower Semiconductor raises funds to push product and customer momentum

One of the world's leading providers of integrated voltage regulators (IVRs), Empower Semiconductor recently announced the closing of a $30 million equity financing round led by an international group of strategic and institutional investors. The company plans to utilise the funds to accelerate the development of its advanced integrated voltage regulator (Empower IVR) semiconductor technology and continue to build its international sales and engineering team. Notably, the present investment doubles Empower's previous valuation, and the company plans to bring state-of-the-art, high-speed power architectures quickly to market.

Dronamics secures $40 million in pre-Series A Funding

Before approaching its Series A fund round, leading global cargo drone airline Dronamics secured a total of $40 million in pre-Series A funding from venture capital funds and angel investors from 12 countries recently. Founders Factory, Speedinvest, SeedBlink, Eleven Capital, and Strategic Development Fund - the investment arm of the Tawazun Council, Abu Dhabi, United Arab Emirates, were among the major contributors to the company's pre-Series A funding. The company will establish a UAE based joint venture with Strategic Development Fund, which will provide additional significant investment, as a main partner.

Atmosic and Epishine partner to develop self-powered beacon

Energy harvesting wireless platform innovator Atmosic Technologies has partnered with Sweden based organic solar cell maker Epishine to create an ultra-thin self-powered beacon, marking a significant step forward for low-power electronics and industrial Internet of Things. A beacon is a small hardware transmitter that transmits signals to nearby receivers like a smartphone or any other Bluetooth-enabled device. Atmosic's beacon utilises its ATM3 Bluetooth SoCs along with Epishine's indoor solar cell and can operate without batteries. The companies said that this would reduce battery waste and help drive a greener Internet of Things with a substantially lowered total cost of ownership.

in the world who have their own ATS system.

MeitY Secretary inaugurates Advanced Electronic Materials Laboratory at C-MET, Thrissur

In a recent development, the Secretary, Ministry of Electronics and Information Technology (MeitY), Alkesh Kumar Sharma (IAS), inaugurated the Advanced Electronics Materials Laboratory at the Centre for Materials for Electronics Technology (C-MET), in Thrissur. The Secretary also launched three IoT sensor based products, which include a smart digital thermometer, IoT enabled environmental monitoring system, and multichannel data acquisition system developed by C-MET in the Centre of Entrepreneurship.

AICTE launches curriculum for technical courses in chip making, VLSI design

In a recent update from the educational corridors of India, the All India Council for Technical Education (AICTE) has launched a curriculum for two new courses: B.Tech in Electronics Engineering (VLSI Design & Technology) and diploma in IC manufacturing. The programs aim at employment generation and salary incentives for students studying in India. The courses will be uploaded on the AICTE portal. The official statement said that any AICTE-affiliated college/university/technical institution may opt to offer these courses. These programs aim to provide newer employment opportunities and salary incentives for the students.

Renesas and TCS collaborating for hardware design and software solutions

Major IT services company, Tata Consultancy Services (TCS), and a leading supplier of advanced semiconductor solutions, Renesas Electronics Corporation, have announced the opening of joint innovation centres in Bengaluru and Hyderabad to collaborate on radio frequency, digital and mixed-signal design, and software development for innovative next-gen semiconductor solutions catering to the needs of a wide range of industries. As per the partners, the centres will combine TCS' deep expertise in IoT and domain knowledge of the manufacturing, telecom, and automotive industries with Renesas'

Calendar of Forthcoming Electronics Fairs/Exhibitions/Seminars/Events

Event, Date and Venue	Topics	Contact address for details
Mouser Electronics IoT Technical Roadshow 2023 **Bengaluru** June 9, 2023	Disrupting the Status Quo: The Emergence of Industry 4.0 and Its Implications	Website: https://www.electronicsforu.com/events/iot-technical-roadshow-2023-bangalore
Mouser Electronics IoT Technical Roadshow 2023 **Pune** June 16, 2023	Revolutionising Transportation: Vehicle Electrification Connectivity & HMI	Website: https://www.electronicsforu.com/events/iot-technical-roadshow-2023-pune
Mouser Electronics IoT Technical Roadshow 2023 **Chennai** June 23, 2023	The Future of Factory: Harnessing the Power of Smart Manufacturing	Website: https://www.electronicsforu.com/events/iot-technical-roadshow-2023-chennai
Open Source India 2023 NIMHANS Convention Center, Bengaluru October 12-13, 2023	Open Source For You magazine, in partnership with India's Open Source community and industry, brings various stakeholders under one roof to accelerate development and deployment of open source in India, and beyond.	Website: https://www.opensourceindia.in
India Electronics Week KTPO, Whitefield Bengaluru February 7-9, 2024	India's No. 1 event for creators of smart electronics solutions to discover latest techniques, best practices and technologies for developing electronics better, cheaper and faster, and meet service providers, suppliers and partners who can enable growth of your business.	Website: www.indiaelectronicsweek.com
IoTShow.in 2024 KTPO, Whitefield Bengaluru February 7-9, 2024	The conferences and hands-on workshops, cutting-edge talks and trainings by industry stalwarts and thought leaders will help build the skills you need to get ahead in the field.	Website: https://www.iotshow.in

Since this information is subject to change, all those interested are advised to ascertain the details from the organisers before making any commitment.

advanced semiconductor designs and skilled embedded software support.

Government to disburse production-linked incentives to contract manufacturers

The government has announced disbursement of financial incentives worth ₹76.5 billion under the production-linked incentive (PLI) scheme for large-scale electronics manufacturing, with the majority share of incentives directed towards Apple's contract manufacturer Wistron. Data provided by India Cellular and Electronics Association shows that the government would release financial incentives worth over ₹60 billion to Wistron, followed by nearly ₹15 billion for Indian contract manufacturer Padget (Dixon Technologies).

Mouser Electronics to host 4th IoT Technical Roadshow Series for 2023

Leading global semiconductor and electronics components distributor, Mouser Electronics, Inc., has announced the fourth edition of its five-city IoT Technical Roadshow Series for 2023. The company has invited electronics and embedded engineers to join the series that will feature the latest products, technologies, and solutions for the Internet of Things (IoT) applications. It is noteworthy that each city's roadshow has topics fine-tuned for its audience of design engineers, IoT leaders, practitioners, FAEs, technology experts, EMS, OEM and ecosystem enablers. The five-city conference will cover topics such as digital twin, powertrain, ADAS, wireless technology, 6G, Industry 4.0, vehicle electrification, connectivity, HMI, and smart manufacturing.

Honeywell and IISc collaborate to support deep-science startups

Leading automation solutions provider, Honeywell, recently announced that Honeywell Hometown Solutions India Foundation (HHSIF)—its philanthropic arm—has partnered with IISc's Society for Innovation and Development (SID) to continue supporting deep-science startups to encourage entrepreneurship and scientific innovations. With this initiative, the company aims to bridge the gap that startups face between incubation and early seed investments. It is noteworthy that Honeywell partnered with IISC-SID in 2019 to support such startups and Entrepreneurship-in-Residence (EIR) programs. Startups like Dfine Bio-innovations, HEM Dimensions, Open MedLabs, and 14Si Silicon Solutions are supported by Honeywell and are incubated at IISc-SID.

V-Guard and ESAF Bank collab to finance rooftop solar systems

Leading electronics and electrical manufacturer based in India, V-Guard Industries Ltd, recently signed an MoU with ESAF Small Finance Bank to provide financing options to customers looking to install V-Guard's solar rooftop power system. As per the deal, ESAF Bank will provide various financing options, including loans and instalment payment plans. Consumers can opt to finance up to 80% of the total cost of the rooftop solar power system, including the cost of installation for residential or commercial applications. The partners hope that the initiative will reduce the burden on customers to make an upfront payment and enable them to generate their own electricity, thereby reducing their dependence on the grid.

Crompton Greaves launches 300+ energy-efficient ceiling fans

Crompton Greaves Consumer Electricals has introduced more than

SNIPPETS

- US-listed Intel slashes quarterly dividend by 65%
- TSMC to build second foundry in Japan
- Leading provider of software and services for embedded development, IAR gets a new name and look to support its strategic mission
- Harwin fuels custom cable assembly resources with new HRi business unit
- Indian chip industry to reach $55 billion by 2026, according to Deloitte
- Semtech, The Things Industries partner to bring LoRaWAN and cellular solutions to market
- Aspinity's Application Board integrates with Renesas Quick-Connect IoT Platform to enable near-zero always-on system power
- Hexagon and Altium partner for sustainability in the electronics industry
- Microchip Oregon plant to receive $42.4 million incentive under US CHIPS Act
- Silfab Solar set to execute first phase of its USA cell manufacturing facility

300 new energy-efficient star-rated ceiling fan models, switching from its older ceiling fan range, effective January 1, 2023, in compliance with the new Bureau of Energy Efficiency (BEE) norms. To incorporate this technology, the company has undergone process transformation at all its nine different production plants. This new product portfolio comes with brushless direct current (BLDC) motors, which utilise direct current electricity and do not have any brushes that are responsible for conducting electric current to the rotor as in traditional DC motors, reducing energy consumption by up to 60%.

India and USA to sign MoU on semiconductors for electronics supply chain

While visiting India to attend the India-US Commercial Dialogue, the US Secretary of Commerce Gina Raimondo said that the two countries will sign an MoU on semiconductors that will support India's aspiration to play a leading role in the electronics supply chain. On the occasion, the US Secretary also met Foreign Minister S. Jaishankar in Delhi, where they held a discussion on the resilient and reliable supply chains and trust and transparency in the digital domain. The visiting official commented, "Just a few weeks ago, Boeing and Air India announced an order for 220 aircraft which is a historic deal that reflects the strength of our economic relationship and will support a tremendous number of jobs in the United States," while adding that the two sides agreed to launch the India-US Strategic Trade Dialogue.

Reliance to invest in 10GW solar energy project in Andhra

At the Andhra Pradesh Global Investors Summit held recently, Mukesh Ambani said that his company Reliance will set up a 10-gigawatt solar energy project in the state. Further, he announced that the company will create 50,000 new job opportunities here and will promote the sale of products made in the state through retail business. He addressed the gathering saying that RIL has invested over ₹15,000 billion in kg d6 assets developing and supporting the gas pipeline. At the summit, he also suggested that the rollout of Jio True 5G will be completed before the end of 2023 across the country. He added that with an investment of over ₹4,000 billion, Jio has created the largest and best digital network footprint in the state.

Foxconn to manufacture Apple AirPods in Telangana from next year

Taiwanese contract manufacturer Hon Hai Precision Industry (Foxconn) has bagged an order to make AirPods for Apple Inc. and plans to build a factory in Telangana to produce the wireless earphones. With this, Foxconn has become an AirPod supplier for the first time. AirPods are currently made by Chinese suppliers. Foxconn would reportedly invest more than $200 million in a new AirPod plant in Telangana. As per the report, a subsidiary, Foxconn Interconnect Technology Ltd, plans to start construction of a manufacturing facility in Telangana in the second half of this year and begin production by the end of 2024.

STPI announces second Bengaluru Entrepreneurship Centre in Jayanagar

Software Technology Parks of India (STPI) under the Ministry of Electronics and Information Technology (MeitY) has announced that its second Centre of Entrepreneurship (CoE) in Bengaluru would come up in Jayanagar. EFY has learnt that the new CoE in Jayanagar would be focused on incubating startups working in the efficiency augmentation segment. STPI already has a CoE in Bengaluru, called IoT OpenLabs. The lab has been set up to provide a platform, resources, and support to innovative startups to develop IoT based applications, products, and solutions for the domestic as well as global market. IoT OpenLabs is the first of 22 CoEs for emerging technologies across the country.

Foxconn to set up iPhones manufacturing plant in Bengaluru

After injecting $500 million into its Indian subsidiary, Taiwanese contract manufacturer Foxconn Group has now entered into an agreement with the state government of Karnataka to set up an electronics manufacturing and assembly unit on the outskirts of Bengaluru. The company will reportedly invest up to $1 billion in the proposed manufacturing unit and make iPhones for Apple. State government announced that the plant would come up on a 300-acre plot near the Bengaluru international airport and would generate 100,000 jobs over the next 10 years.

The *Mantras* For HIGH-TECH STARTUPS' SUCCESS

Dauntless! That is what defines the Indian high-tech startup ecosystem, which continued to grow through a pandemic and propelled the electronics industry to aspire for a new goal—a $300 billion industry by FY26. Realising this ambitious goal is no mean feat as the very drivers of this goal continue to struggle to emerge out of the struggling startup stage and become an established business. Yashasvini Razdan from Electronics For You writes on how high-tech startups can steer through the challenges that come their way

YASHASVINI RAZDAN

Eight years ago, on August 15, 2015, the Prime Minister of India announced a new initiative called the Startup India Campaign to catalyse startup culture and build a strong and inclusive ecosystem for innovation and entrepreneurship in India.

In the past eight years, India has grown to become the third largest ecosystem for startups after the US and China. In December 2022, the Department for Promotion of Industry and Internal Trade (DPIIT) declared that the number of startups in India has grown from 452 in 2016 to 84,012 in 2022 of which 23,773 came into being in 2022 itself.

Despite the glorious numbers, 90% of the startups fail, of which 10% fail in the first year and 70% fail between the second and third years. Many would attribute this to a lack of funding, unclear vision, and inadequate resources. Whitewashing the failure of startups using these three reasons isn't going to help. To reduce the percentage of failure one needs to dive deeper into the reasons why startups fail, especially in the high-tech sector.

Traversing through 'the road not taken'

Bengaluru is the hub for startups and traffic, of course! Right from choosing the correct transportation to factoring in the time taken to book a ride, pre-planning one's journey before heading out is a must. Building a startup is akin to planning a journey via 'the road not taken' and entrepreneurs need to follow the same step while finalising their destination.

The first rule to planning the startup journey is very obvious—a business plan! Far too many startup founders think a pitch deck is a business plan, which is a very wrong notion. A business plan is a live document, which is constantly revised and not something with a pretty ring binder only to be forgotten about later.

Trudging alone, on the road not taken, is a daunting task but a partner can surely make the journey easier. For startup entrepreneurs, choosing the right co-founder is like selecting the right life partner. Co-founders with complementary skills and those who mutually agree on the business plan can make it easier to navigate through the whirlwind of challenges encountered by a startup.

The co-founders need to be clear on the goals they aim to serve. Do they wish to be a product startup or a services startup, or do they want to sail on both the boats? Product development just for the sake of innovation does not warrant the sustenance and growth of a startup.

To be successful, startups need to converse, interact, and talk to at least 50-100 customers in a particular segment to identify their needs and build a product that serves those needs and eventually sells. Asking the right questions that get a customer to open up about their requirements, allows entrepreneurs to formulate and obtain more clarity on how their product should get developed. These customers can later be approached again, once the prototype is ready, to check whether it meets their needs.

By this time, the ringing question that would come to an entrepreneur would be, 'How does one collate all that information to understand and utilise it?' Big manufacturers go to market research firms but startups lack the capital to afford that kind of luxury. So, they can make use of open source tools, such as a Google Dashboard, which is free. Crunching numbers, simulating data, creating a demo—it offers all.

While these shortcuts do help attract investors and generate the interest of potential customers, startups should remember that these are tools to aid them and not crutches to depend upon. Products developed by startups are designed to ease the life of customers, but the startups cannot take a shortcut to achieve their goal. So, relying on sources such as GitHub without understanding the specific application context can prove to be disastrous in the later stages of product development.

While finalising the destination and route, entrepreneurs need to gauge the time it would take for their startup to achieve its goals. Factoring lead times and the cost of raw materials is an indispensable part of this planning stage. Covid-19 and the semiconductor supply crunch have shown us that entrepreneurs need to be prepared for all supply-chain issues they may face.

Tackling the bull

Product development is a long-drawn process. After crossing multiple barriers, when a startup finally reaches the product development stage, life doesn't become any easier than it had been earlier. Decisions regarding finances and product design can make or break the life of the startup.

> THE GOVERNMENT HAS ANNOUNCED MULTIPLE GRANTS, SUCH AS THE NIDHI (NATIONAL INITIATIVE FOR DEVELOPING AND HARNESSING INNOVATIONS) PRAYAS, AIMED AT PROVIDING PROTOTYPE FUNDING TO CONVERT AN IDEA INTO A PROTOTYPE OF A PRODUCT THAT HAS THE POTENTIAL FOR COMMERCIALISATION FOR ASPIRING INNOVATORS.

Manoeuvring through this battlefield of challenges cannot be done without the guidance of an experienced professional. Having a mentor or a trusted network of individuals to talk to and discuss specific needs can be of great assistance.

If the startup connects with a startup incubator, guidance pertaining to development and business strategy will be readily provided to them. Various Centres of Excellences (CoEs) under the Software Technology Parks of India (STPI) have been set up in different cities of India to assist hardware manufacturers working on disruptive technologies in the electronics industry.

Every startup needs funds and support to come up with a prototype for its customers. Connecting with the correct investors and incubators is similar to finding an escalator to reach the next level of growth.

When looking for investment through private equity investors, startup founders should choose the correct investors who understand the perils of developing a hardware technology product startup. Seeking funding from 'real estate investors' who want 100% returns within a year is the same as drinking soup using a fork! The chef (investor) will keep on wondering why the soup (product) isn't finished.

The government has announced multiple grants, such as the NIDHI (National Initiative for Developing and Harnessing Innovations) Prayas, aimed at providing prototype funding to convert an idea into a prototype of a product that has the potential for commercialisation for aspiring innovators.

Consortium of Electronics Industries of Karnataka (CLIK) President, Madhav R. Badsheshi, told EFY, "Schemes such as Nidhi Prayas provide a grant of ₹10 lakh (one million rupees) to startup companies or entrepreneurs. In the beginning, for making the initial prototype, this amount suffices but as you go up the ladder, you'll need more funds. You'll need a lot of money for a market survey alone! You'd need to study the market, and after getting the inputs, you'll have to adjust your business plan."

To reap maximum benefits from investors, entrepreneurs need to have a clear understanding and focus on what product they are going to build. Most of the work is already done if the innovator has a fine business plan. Along with that, the entrepreneur needs to highlight the innovation and explain what other options are already available in the market.

Investors need to know the reason they should invest in a particular startup. With a detailed but very articulate business plan, startup founders can convince the investors to invest in their startup even before they come up with a minimum viable product (MVP).

Moving on from the ideation to an actual proof-of-concept (PoC) phase is the next challenge in the life of a startup. To come up with an MVP, the startup needs to go back to those customers they spoke to during the ideation phase.

"You need to have a set of specific questions for your customers and constantly refine your idea to make it useful. Don't try to boil the ocean at this stage and add up all of the features into one product. That will take another year," cautions Bharat Innovation Fund partner Somshubhro Pal Choudhury.

Choudhury's warning is further supported by Maker Village CEO, Nizamuddin Mohammed, who articulates the need for rapid prototyping. He says, "With every hardware product, you need rapid prototyping. We call it the fail-fast technique. You need to come up with a product fast, test it out with the customer in your target segment, and then iterate on it."

Once customer interest is generated and the MVP is ready, startups need to start minting money. The sustainability of a startup depends entirely on how much money it has in its coffers and how it gets the cash flowing. Taking eyes off the cash flow at any time means a sure death for the startup.

Choudhury explains how startup founders can do pricing discovery at this stage. He advises startups to engage in a repeatable kind of business that ensures recurring revenue, which would get the investors excited. "When you do a pilot PoC with the customer, do not go for a free PoC. At least get some money out of the customer. This way their willingness to pay gets tested," he says.

Choudhury also underlines the importance of the founders doing the first few sales, instead of sending in a sales representative, to get the actual feedback from the customers.

Trudging through the last mile

A few years ago, a telecom infrastructure company in Chennai deployed the equipment to be used in a beautiful cast iron casing. While the cast was designed to perfection, the company made one mistake. They forgot to put powder coating on the cast iron casing. Within a year of deployment, the telecom provider asked them to change the equipment as it had rusted and didn't work anymore.

Renowned electronics industry advisor PVG Menon, who chaired the panel discussion at the IEW 2022, narrated the above story. It was to explain to the audience how the company had gone ahead with product development without understanding their deployment scenarios and support requirements.

More than often, companies develop their product in an industrial environment and forget to account for additional support requirements in a remote deployment scenario. Too many aspiring hardware startups struggle to distribute their talent and skill uniformly across all sectors of the business. Many times, the most efficient task force is deployed towards product development while

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the sales and marketing segments share the same fate as the middle-born in a conventional *desi* family—ignored and left to their own devices.

Electric vehicle startup Greendzine Technologies' co-founder, Karthikeyan Sundaram, talks about his own experience and issues a cautionary warning for all entrepreneurs. "We assumed that since our engineering design and product are good, we could relax on the marketing front, but that was not correct. We had to learn marketing and sales, which was the biggest learning struggle we had to go through for a long time. If I had to establish a startup again, then I would focus more on marketing, sales, branding, as well as engineering, and not the other way around," he told EFY.

Internet of Things startup Refillbot's director, Prabhu Stavarmath, elaborates on brand-building and scaling up on marketing. "Brand building is very important once you have a product, so that your prospective customers can discover you, through Google, LinkedIn, or even the newspaper. For some, it happens organically as well, but it's always good to have some basic marketing in place and a brand built in the early stage. From thereon, you just need to scale up," he opines.

Adding to that, co-founder and director of the startup Silizium Circuits, Rijin John, shares with EFY his experience with customer interaction and the role it plays in helping the startup design its intellectual property (IP). "Our IP roadmap was purely based on our potential customers with whom we had already spoken and who were interested in our product. We wanted our product to be at par or better than the imports of IPs. We successfully taped out our first semiconductor IP in September 2022."

The year is 2023. Gone are the days when the term startup would just imply a new application software. India is witnessing a sweeping growth of startups in the high-technology sector. Despite the plethora of opportunities available, innovators in this arena are facing a lot of challenges ranging from finance to human resources and from launch to sustaining growth with tenacity.

It is important to ensure and aid the success of these high-tech startups as they hold the potential of creating jobs in the manufacturing sector and realising India's dream of achieving a $300 billion electronics industry. With appropriate support, synchronisation, and mentoring from stakeholders, the government, and the electronics industry, startup innovators can easily manoeuvre their way to success. EFY

A Three-Step Process To PREDICTABLE SALES

Having a process to get in front of a prospective customer without manual intervention and then genuinely helping them reach logical decisions via a diagnostic process is one of the critical assets in a small business's arsenal

ANAND TAMBOLI is a serial entrepreneur, speaker, award-winning author, and an emerging-technology thought leader

Would you like to increase your business revenue? I haven't heard a "no" from anyone ever. But when I ask, "Do you have a process to generate revenue consistently?" then I get a range of answers.

For most startups and small businesses I speak with, I hear one common frustration. For them, it is super frustrating not being able to reliably forecast the topline. But without a process, this rollercoaster ride will continue.

Predictable sales are the key to predictable topline and hence the growth. It also makes your valuation easier to defend or arrive at. Having this process is one of the biggest assets you can have.

What's the typical process?

For most people, networking and advertising seem to be obvious answers. This is why we all have seen people jumping to sell each other at networking events, including conferences, or other meetups. Unfortunately, it is not only tacky but also ineffective.

How many of us pay attention to advertisements or not skip them? It is obvious that people don't like watching ads, unless forced to do so.

So, if networking doesn't work, ads don't work either. Then, what works? How do you make sales work, let alone make it predictable?

The first step to making sales predictable

Customers don't just go to a shop or an online store and buy things. In most cases, there is a lot that goes on before that step occurs. And to understand that we have to understand the customers' journey as a whole.

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Ask yourself, how do customers reach the decision to buy the product you're selling? How do they make the decision to buy from you? How does that process work for them?

Once we understand the process a customer goes through, all we have to do is to facilitate that decision-making for them, preferably in our favour. I don't mean in our favour for the sake of it, but because we believe that our product or service is better than the competition.

The first step is not to jump and begin with a sales pitch but to follow the three-step, proven, and meaningful process.

Understanding ZMoT

ZMoT is the term coined by Google. It means the Zeroth Moment of Truth. They use it to describe the moment when a customer decides to research a product or service before making a purchase. It occurs before the traditional "First Moment of Truth" when a customer encounters a product in a store.

Obviously, ZMoT is the result of the growing influence of the internet and how customers have been making decisions using it. As a first step, customers almost always turn to online resources to gather information about a product or service. These resources could be search engines, social media, review sites, or your website in many cases.

The information they gather from all these sources eventually influences their decisions. It can shape their perception of a brand and the product. That makes it crucial for businesses to have a strong online presence and provide valuable information to potential customers during this critical stage of the buying process.

Most companies I worked with often misunderstand the "provide valuable information" aspect. While they ensure their presence everywhere in the online world, they often clutter it with sales and marketing collateral. So, when a prospective customer is trying to assess the product or service, all they get is a sales pitch, again!

Instead, ZMoT suggests creating content that is helpful, informative, and relevant to the customer's needs. Because when we do that, it becomes easier to establish trust. That often, if not always, increases the likelihood of converting potential customers into loyal ones.

Combining ZMoT with diagnostic resources

Understanding ZMoT is essential but how do we turn it in our favour? The key is in understanding why people buy. What actually happens when people buy? What triggers them? Is that an advertisement one saw? Certainly not.

What makes people buy, including you and me, is the difference between our current reality and the expected or ideal reality. If I want to look a certain way, and if I don't at present, then there is a gap. And any product or service that can help me look the way I envisage, or want to, may be purchased by me.

That means, understanding this gap as a business is important. But more important is to make it visible to the customer. I have seen that the business which makes this gap visible often becomes the first choice for many customers. Therefore, combining the knowledge of ZMoT with diagnostic resources is critical.

In my previous company, Knewron Technologies, we often used to conduct a diagnostic assessment. In some cases it was free and in other cases it wasn't.

One of the commonly used tools, which was also designed by us, was the diagnostic quiz—an online self-assessment that could spit out the outcomes based on the answers given by the prospective customers. Customers, when researching online would come across our tool, they would access the quiz and get the results instantly. With those results, two things happened.

First, it helped customers to instantly find and articulate gaps. It helped them clarify their problem a bit further. And this process brought them one step closer to us.

Second, it gave us basic insights into their problems. That is why building such diagnostic quizzes or checklists is critically important.

Converting diagnostic results to a conversation

As the results of our diagnostic quiz were recorded, we knew areas of improvement early on; well before our prospective customers engaged with us. Many times, we initiated that conversation, and other times, they contacted us after seeing the results. But in both cases, the conversation we had wasn't cold.

It wasn't a cold lead we were trying to convince. The conversation we had was of better quality and meaningful for both, our business and the customers. Instead of having a typical sales pitch or sales conversation, it was more of a facilitation to solve their problem with our services and tools.

There have been instances when prospects chose to go with our competitor instead of buying from us, but that decision was beneficial for both of us. We were certain (and so were the customers) that a gap existed, and a problem existed. So, it wasn't whether to buy the product. It was more about whether to buy it from us or not. And that came down to typical logical and emotional factors.

Pricing, delivery, terms, etc are some of those logical factors. If they don't match customer expectations, the sale won't happen, and we won't regret it. But as far as the emotional factor is concerned, we had always won in that department, because we facilitated a meaningful conversation instead of being salesy.

Once someone decides to buy from you, the next steps are clear to all of us. Almost every business knows how to supply the product, service it, maintain it, and so on.

Back to ZMoT

One of the things important for ZMoT is how people warm up to you, your product, and your company. It surely doesn't happen with one so-called whitepaper or a bunch of case studies. It happens on several different platforms, over several days, for them to reach the level of trust.

Think about it. If you don't know anything about the person and you meet the person for the first time, and make an offer, why do you think that person would buy from you? If nobody knows you enough, and if there's no trust established, how and why will that happen?

On the contrary, when we work with a person for a few days or a few years, we start to understand their value system, their principles, and several nuances. Then it gets easier.

According to ZMoT, it typically takes seven touchpoints that a customer interacts with on average before making a purchase. The average number of sources that a customer consults during this step is eleven. And quite often they ask at least four questions. These questions are focused on gathering information about the product or service and can include questions about features, pricing, quality, and other aspects.

Do this today

Having a process to get in front of a prospective customer without manual intervention and then genuinely helping them reach logical decisions via a diagnostic process is one of the critical assets in a small business's arsenal. All this begins with understanding your customer's journey.

At Knewron, every time we had a conversation with our prospects, we rarely had rejection. The deal almost always went through. Maybe that's the reason I never thought of this as a separate process.

What I am suggesting is that you do this on purpose and have this process set and documented. Once the process is set, any salesperson will feel more comfortable and will be able to make a home run. EFY

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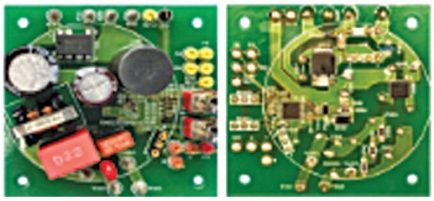
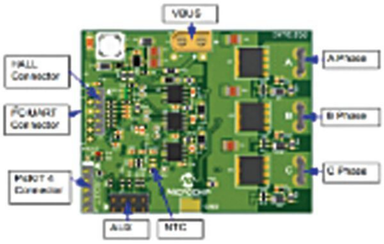
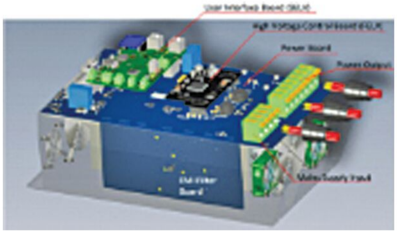
Reference Designs Of MOTOR DRIVES

Title of Reference Design	3-Phase Brushless DC Motor Drive	12V BLDC Motor Drive for Automotive Applications
Image		
Type	3-phase BLDC motor	BLDC
Power	90-264V AC	12V
Wattage	10W	200W
Key Attractions	Reference design for a low-powered BLDC motor drive that can take input from a regular AC home socket (90 to 264 volts) and is capable of running a small 10W motor at 12V DC.	Reference design for a low-powered BLDC motor driver that features an onboard temperature, voltage, and current sense, which allows adding fault-protection and diagnostics features easily to the motor drive.
Highlights	The REFMOT201 is a reference design by ROHM for a 3-phase brushless DC motor drive. The design enables direct input of AC power to a BLDC motor unit by installing an AC-DC converter circuit in the drive circuit for a 3-phase BLDC motor. The design has a 3-phase motor driver plus AC-DC converter (12V output) integrated into a single board. The main advantage of this reference design is its higher efficiency, higher power density, and better torque-to-weight ratio. These features enable the drive to have a smaller footprint and lower volume. The reference design offers precise control over motor speed and torque, making it ideal for applications where accuracy is critical. The low-powered reference design offers higher reliability and low noise and vibration, making it suitable for use in low-powered consumer electronics, such as toys and small fans.	TIDA-00901 is a reference design from the Texas Instruments for a 200W BLDC motor drive. It simplifies the design complexity as it doesn't require any position sensor, such as a quadrature encoder or a hall effect sensor. This design includes an analogue circuit that works with a microcontroller, a C2000 LaunchPad to control the speed of a 3-phase BLDC motor. The design is suitable for harsh automotive environments, such as operation at a wide range of temperatures from –50°C to +150°C. The motor drive can work with a 12V battery and has a wide range of operating voltage from 4.4V to 45V. It is compatible with the existing MotorWare software, thus further simplifying the development process and providing a 3.3V supply for LaunchPad operation.
Application	The reference design is suitable for low-powered consumer electronics and toys.	The reference design is suitable for use in e-bikes, toy cars for kids, etc.
OEM Brand	ROHM	TI
URL	https://www.electronicsforu.com/electronics-projects/industry-grade-projects/reference-design-for-a-three-phase-brushless-dc-motor-drive	—

For Different Applications

The author, Sharad Bhowmick, works as a Technology Journalist at EFY. He is passionate about power electronics and energy storage technologies. He wants to help achieve the goal of a carbon neutral world

Low Powered E-Scooter Motor Drive	3-Phase PMSM Drive	22kW Industrial Motor Drive
 VBUS HALL Connector I²C/UART Connector PICkit 4 Connector AUX NTC A Phase B Phase C Phase		 User Interface Board High Voltage Control Board Power Board Power Output Mains Supply Input EMI Filter Board
BLDC	PMSM	3-phase induction motor
18V to 24V	230V AC	400V AC
350W	1.5kW	22kW
Reference design for e-bike motor controller that can take input from 18V to 24V and deliver a maximum power of 350W. The design is capable of driving both a BLDC motor as well as a PMSM motor of up to 350W power.	This reference design for a 3-phase PMSM drive with a 32-bit microcontroller includes a low-voltage MOSFETs power stage and a communication stage. The design is suitable for motor drives for drones, compressors, air-conditioners, fans, air extractors, pumps, and industrial drives, etc.	This reference design is for a 22kW industrial motor drive for 3-phase 400V AC grids. The motor driver can take input from 380 to 480V AC. The reference design is highly customisable and can be used for both low-powered and high-powered applications.
The dsPIC33CK64MP105 DSC motor controller from Microchip is a high-efficiency design suitable for e-mobility solutions. It is suitable for low-powered e-scooter and e-bikes. The reference design can take input from 18V to 24V and deliver a maximum power of 350W. It is capable of driving both a BLDC motor as well as a PMSM motor of up to 350W power. The brain of this design is digital signal controller (DSC), dsPIC33CK. The single-core dsPIC33CK DSCs accelerate digital signal processor (DSP) performance for time-critical applications. This design also employs six MOSFETs with low RDS(on), which enhances safety as the MOSFETs can handle high phase currents without excessive conduction losses. The design offers high efficiency, compact dimensions, and low cost while providing high performance.	The YROTATE-IT-RX111 is a motor drive for a 3-phase permanent magnet synchronous motor (PMSM) or AC brushless motor that employs an advanced sensorless field oriented control algorithm. The design is compatible with other existing motor control reference platforms with external power stages delivering up to 1.5kW at 230V AC. The reference design features a microcontroller (MCU) from Renesas 32-bit RX MCU family. The main advantage of the design is that it is simple and economical. The reference design allows the user to monitor and tune various parameters using the graphical user interface provided by the company. The design is highly customisable and allows the user to select the best switching frequency and control frequency to adapt the control dynamics suitable to the application requirements. This enables any designer to make the right compromise between system dynamics, CPU load, and overall efficiency.	The REF-22K-GPD-INV-EASY3B is a reference design of an industrial-grade motor drive from Infineon. The motor drive is suitable for 3-phase 400V AC grids and has a nominal power of 22kW. It includes a power module, current sensor, gate driver IC, and a 1.7kV SiC-MOSFET. The reference design features two microcontrollers and can be divided into five separate boards: power board, EMI filter, high-voltage logic board, low-voltage interface board, and DC-link board. This makes the reference design highly customisable with respect to specification and size. Furthermore, it allows for better isolation between different subsystems, making the reference design safer and more reliable. The design also features software that enables full control and communication via touch screen and PC-GUI. The reference design can take 3ϕ input of 380 to 480V and provide a wide range of output from 0 to 456V with a rated current of up to 45A. The reference design can be used for both low-powered motor control as well as high-power applications, such as conveyor belts and compressors.
The reference design is suitable for use in e-bikes, electric lawnmowers, etc.	The reference design can be used to make motor drives for drones, compressors, air-conditioners, fans, air extractors, pumps, and industrial drives, etc.	The reference design can be used for both low-powered motors like refrigerator compressors and high-powered motors for conveyor belts, and running large compressors for warehouse chillers.
Microchip	Renesas	Infineon
https://www.electronicsforu.com/electronics-projects/industry-grade-projects/reference-design-for-low-powered-e-scooter-motor-drive	https://www.electronicsforu.com/electronics-projects/electronics-design-guides/reference-design-for-3-phase-pmsm-drive	https://www.electronicsforu.com/electronics-projects/industry-grade-projects/reference-design-for-an-industrial-motor-drive

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YOUR OWN SUPERCOMPUTER
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ASHWINI KUMAR SINHA

There are areas where we need small computing machines that can work collectively like a supercomputer. Let us see here how it can be done.

Most supercomputers have interconnected CPUs with a master node CPU that divides a large computing task into smaller tasks. These smaller tasks are assigned to the interconnected CPUs, which work together to finish the task in much lesser time.

So let us design our own supercomputer, which would be a basic system where you can connect as many nodes as you want to fulfill your computation and processing need. We shall use single-board computers and connect them to each other and make one of them the master node. The master node would distribute the tasks and control all the other computers.

The components required for this project are listed under the Bill of Material table. The author's prototype is shown in Fig. 1.

Each node of the cluster for our supercomputer would need the com-

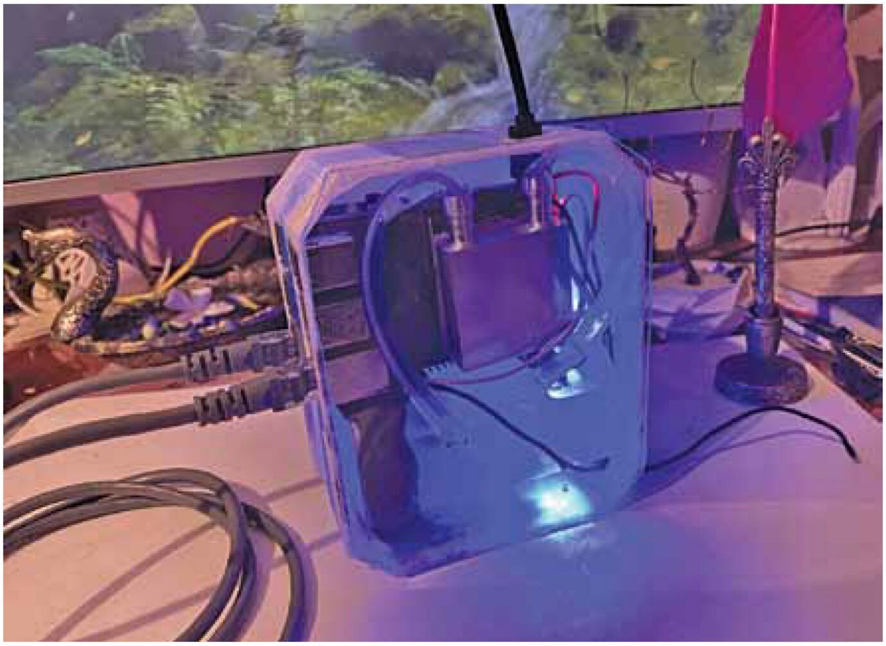


Fig. 1: Author's prototype

BILL OF MATERIAL

Components	Quantity	Description
Raspberry Pi 4GB	Min 2 nodes	Supercomputer nodes
Power adaptor	Min 2 per node	2A
Water-cooled aluminium block	Min 2 per node	40mm×40mm×12mm
SD card 16GB/SSD 120GB to 500GB	SD card min 2 / 1 SSD	100MB/s R/W speed
Thermoelectric cooler	Min 2 per node	40mm×40mm×12mm
7mm dia pipe	Min 4 per node	7mm 5mm orifice
Water or cooling liquid	200ml	Water/Cooling fluid
Water reservoir	200ml	Cylinderical air-tight container
Micro water pump	1 per node	3-5 5V 3mm orifice
Ethernet cable	2 per node	15cm Ethernet cable
3D printed case	1 per node	PLA/ABS 3D printed
Ethernet splitter	1	2 or more ports

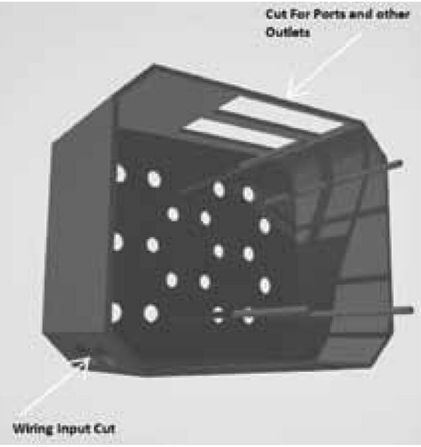


Fig. 2: The case design for a block

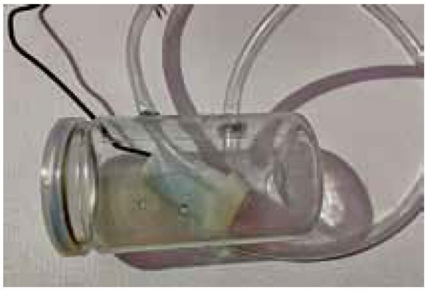


Fig. 3: Inlet and outlet pipes fixed in water reservoir

ponents mentioned under the Bill of Material. To make a cluster supercomputer of 100 RPI, you would need the 100 sets of the above.

Harware designing

You can design either a simple rack based system or design a block of each node and connect the blocks to make a large cluster for personal use. Let us see how you can make a block based cluster supercomputer, where each block has two CPUs with their own separate pre-configured power management and cooling systems. This design gives you the flexibility to add as many individual cluster blocks as required. You can achieve even one terabytes of computing power by adding enough of these single node blocks.

Let us design the single block casing that can hold two RPi single-board computers and the cylindrical water cooling reservoir. In the case design keep two cuts on front side to expose the USB and Ethernet ports of RPi. Keep two holes at the bottom to pass the wires and connectors of power supply (see Fig. 2). Also make some vent holes for air circulation to keep the system cool.

After designing the hardware casing as described above, 3D print it. You can make your own custom design if you like, or even go for a rack based system and set up the cooling system and CPUs in the rack setup.

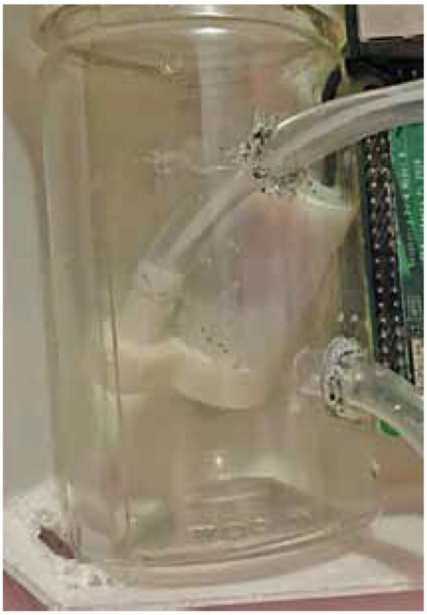


Fig. 4: Water inlet and outlet holes made airtight and leakproof with glue

Fig. 5: Water reservoir lid

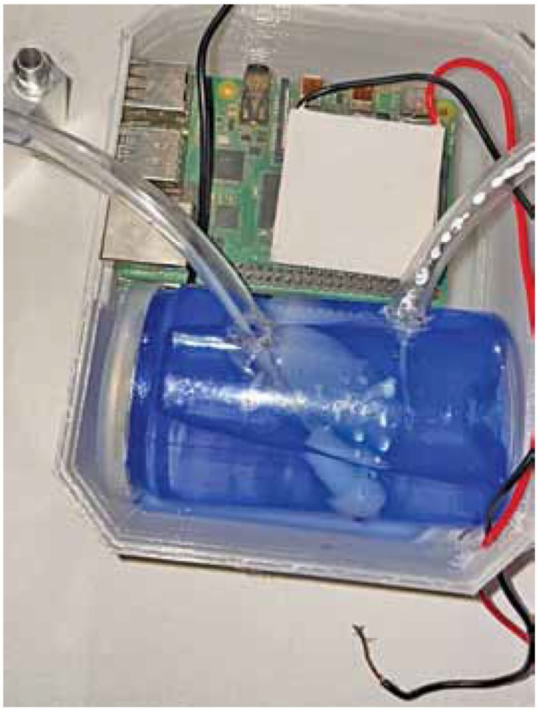


Fig. 6: The reservoir filled with liquid

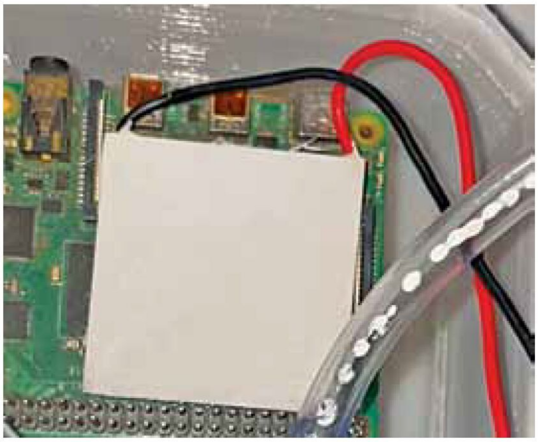


Fig. 7: Thermoelectric module setting on processor chip of RPi

Cooling system

A good cooling system for the supercomputer is necessary as the CPUs would be doing complex tasks and could get heated up quickly. A dual cooling system using first thermoelectric and then water cooling is recommended. For better result, a liquid coolant can be used in place of water.

For the water/coolant reservoir, you can use an air-tight transparent cylindrical container made of glass or plastic, which fits inside the case designed earlier. The reservoir must be leak-proof to avoid any damage to the nearby electronic components or cause a short circuit.

As shown in Fig. 3, make holes for the water inlet and outlet pipes in the reservoir and another hole for the wiring of the immersive water pump. Connect the water pipes and the wires and seal the holes with rubber based glue to ensure there is no water leakage from the reservoir. Refer Fig. 4, Fig. 5, and Fig. 6 for details.

Cover the electronic components in the reservoir with a plastic sheet or cello tape to prevent any water drops formed due to humidity inside do not create any problem. Put the inlet and the outlet pipes inside the aluminium water cooling block (see Fig. 7 and Fig. 8) and connect the water pump and thermoelectric wires to a 5V DC power supply.

Assembly

With the cooling water pump reservoir and whole cooling system ready to mount, you can now assemble the components and start making a block of the supercomputer. First fix the RPi single-board computer inside the case you have designed, as shown in Fig. 9, and mount the first cooling block on that. Next, mount the second RPi inside the case, making sure the ports are exposed and accessible through the cuts in the case that were made for that purpose.

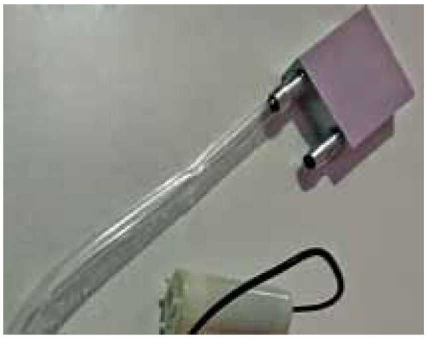


Fig. 8: Aluminium block for water cooling

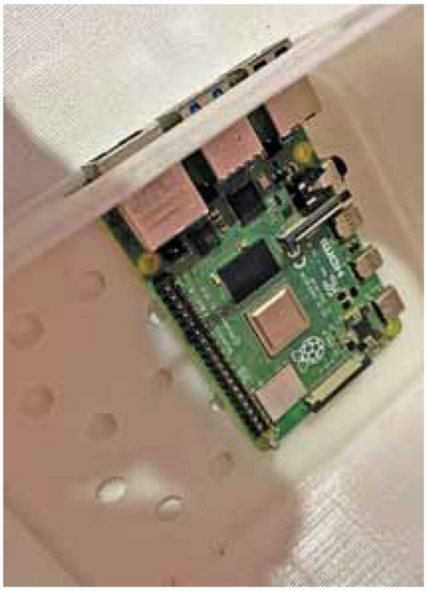


Fig. 9: RPI placed in the case

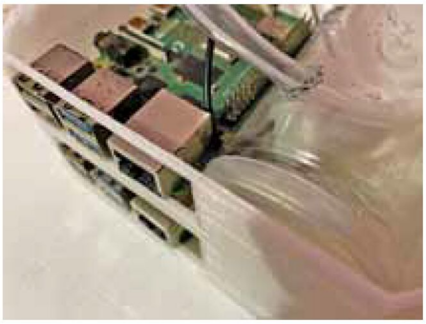


Fig. 10: The reservoir fixed with RPI in the case

Fix the second RPi with a screw and then fix the thermoelectric and cooling block on that as well. Then cover top side of the case. To make it look cool and to see the water flowing, use a transparent acrylic sheet to close the case. The details can be seen in Fig. 10 through Fig. 12.

Refer the connection diagram shown in Fig. 13 and accordingly connect the water pump and thermoelectric cooler to 5-12V, 2A DC power supply and power the RPi with 2A, 5V DC power supply.

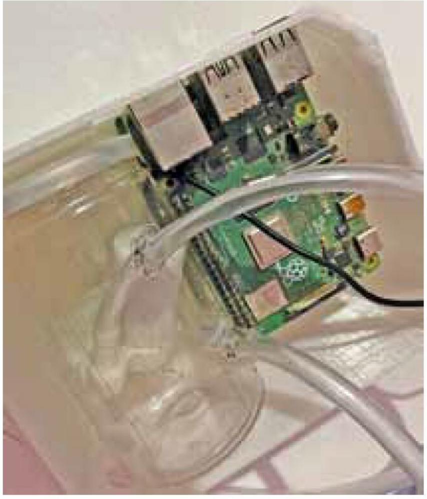


Fig. 11: Top view

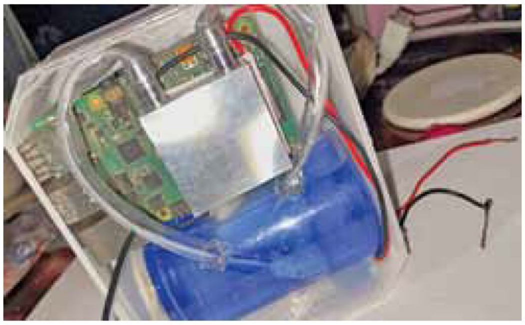


Fig. 12: Fixing of the water cooler module

Software

Install the latest Raspbeian OS in the RPi. Create a master unit that will divide the complex task to all its constituent nodes and control them for processing and calculations, like a supercomputer. To do that, open the Linux terminal and set up the MPI. Install MiPIH and prepare the master node that divides and controls the task among the cluster of computers.

```
sudo apt-get update
```

Change the 'pi' user password.

Under 'Networking,' change the hostname to nodeX, replacing X with a unique number (node1, node2, etc). Node1 will be our master unit.

Setup Ethernet:

```
sudo nano /etc/dhcpcd.conf
```

Go to the end of file and add the following:

```
interface eth0
static ip_address=10.0.0.1/24
```

Then create unique identity:

```
ssh-keygen -t rsa
Setup master node
ssh-copy-id 10.0.0.1
```

Now the master node is ready. Open the terminal of the second node and connect Ethernet to both the RPi with Ethernet connector and repeat the above steps in that as well. For adding more nodes (which can be in thousands) create the bootable image of the above RPi setup and prepare the SD card of all those nodes with the same image.

Connect all of them with an Ethernet connector and boot all of them and set them as nodes of the master using the following commands and configurations. Open the terminal and run the following on each node of the supercomputer:

```
sudo apt install mpich
python3-mpi4py
```

Once complete, test MPI is working on each node:

```
mpiexec -n 1 hostname
```

From node1 (10.0.0.1), run the following command:

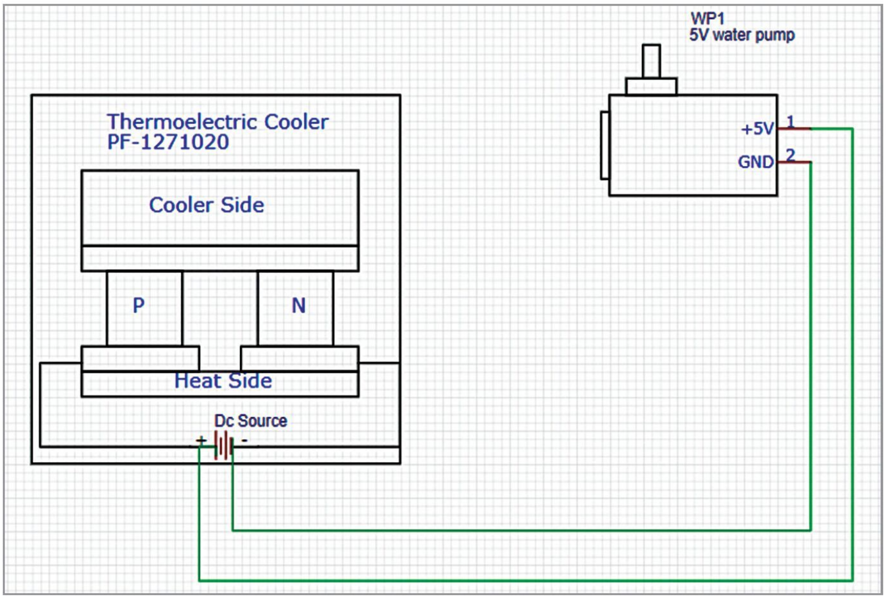
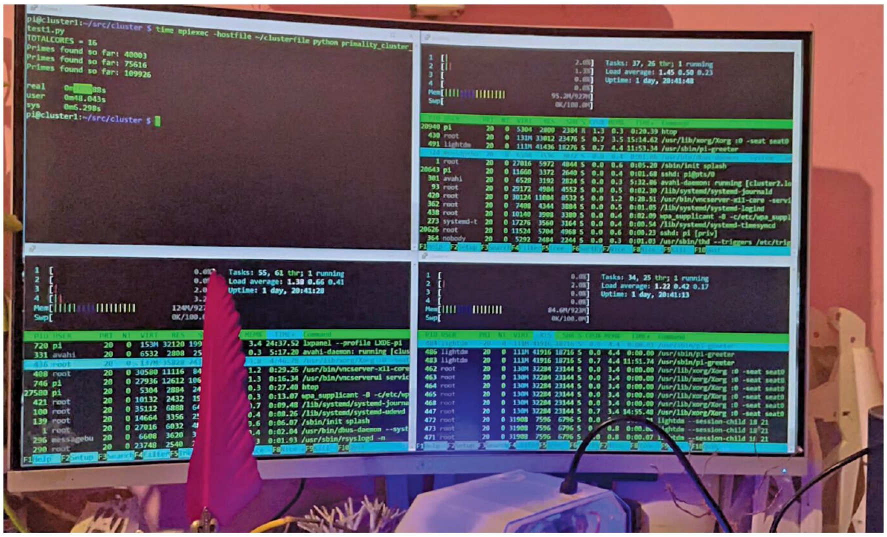


Fig. 13: Connection diagram of the project



```
pi@cluster1:~/src/cluster $ time mpiexec -hostfile ~/clusterfile python primality_cluster_
test1.py
TOTALCORES = 16
Primes found so far: 40003
Primes found so far: 75616
Primes found so far: 109926

real    0m[illegible]88s
user    0m48.043s
sys     0m6.298s
pi@cluster1:~/src/cluster $
```

Fig. 14: Running the code

```
mpiexec -n 4 --hosts 10.0.0.1,10.0.0.2,
10.0.0.2,10.0.0.4 hostname
```

After every setup has gone well, you can test the system. Connect each node and power them all.

To test the supercomputer, download the code from *https://github.com/mrpjevans/cluster-prime*

Open the terminal of the master node and run the following in Linux terminal:

```
mpiexec -n 1 python3 prime.py 1000
```

When you run the above code, the complex task of finding the prime number up to 1,000, or 4,000, or even 100,000, is divided among all the nodes in the system and the nodes process together and calculate to give you the output. Fig. 14 shows how the program runs. **EFY**

Ashwini Kumar Sinha is an IoT and AI enthusiast tech journalist at EFY

EFY Note

The source code of this project is available for free download at *www.electronicsforu.com*

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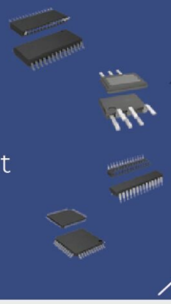

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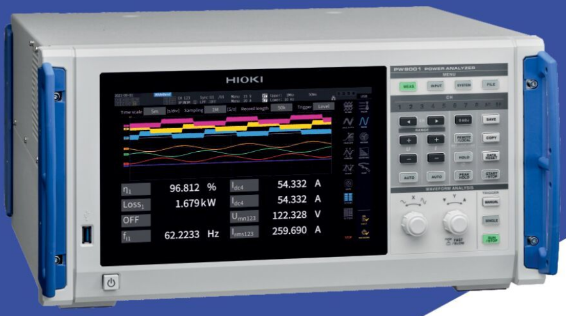

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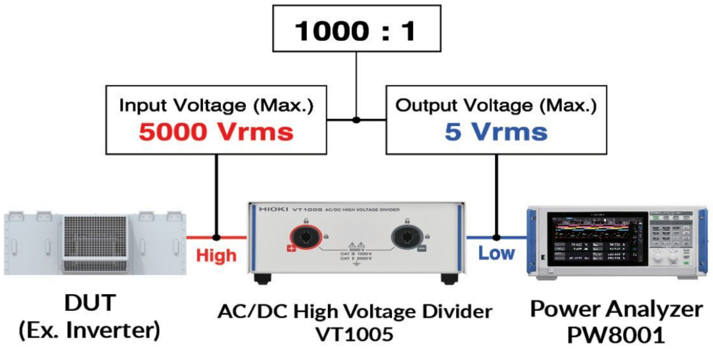
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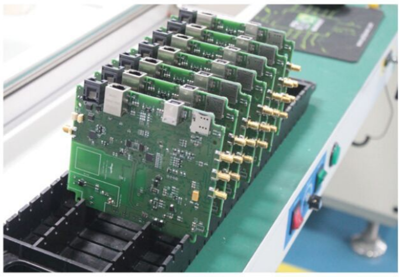

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